

NEW SERIES

VOL. XLVIII.

No. CCXXIV.

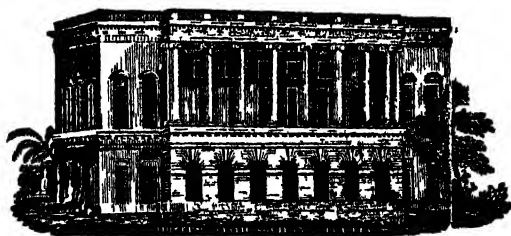
JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL,

Vol. XLVIII, Part II, No. I.—1879.

EDITED BY
THE GENERAL SECRETARY.



"The bounds of its investigation will be the geographical limits of Asia and within these limits its inquiries will be extended to whatever is performed by man or produced by nature."—SIR WILLIAM JONES.

•• Communications should be sent under cover to the Secretaries, Asiat. Soc. to whom all orders for the work are to be addressed in India; or, in London, care of Messrs. Trübner and Co., 57 & 59, Ludgate Hill.

CALCUTTA:

PRINTED BY S. H. ROUSE, AT THE BAPTIST MISSION PRESS,
AND PUBLISHED AT THE
ASIATIC SOCIETY'S ROOMS, 57, FANE STREET.
1879.

Price (exclusive of postage) to Subscribers, Rs. 1-2. — To Non-Subscribers, Rs. 2.
Price in England 4 SHILLINGS.
Issued June 10th, 1879.

CONTENTS.

	Page
I.—On new species of the Genus <i>Plectopylis</i> of the Family <i>Heli- cidae</i> .—By LIEUT.-COL. GODWIN-AUSTEN, F. R. G. S., F. E. S., &c., late Deputy Superintendent Topographical Survey of In- dia,	1
II.—On the Operations for obtaining the Discharges of the large Rivers in Upper Assam, during Season 1877-78.—By LIEUT. H. J. HARMAN, R. E., in charge Assam Valley Series, Survey of India. Communicated by MAJOR-GENL. J. T. WALKER, R. E., C. B., F. R. S., Surveyor General of India,	4
III.—Hemiptera from Upper Tenasserim.—By W. L. DISTANT. Communicated by J. WOOD-MASON,	37
IV.—On the Diurnal Variation of Rainfall Frequency at Cal- cutta.—By HENRY F. BLANFORD, F. G. S., F. E. S., F. M. S., ..	41
V.—Record of the Occurrence of Earthquakes in Assam during 1878.—Communicated by the CHIEF COMMISSIONER OF ASSAM,	48
VI.—On some experiments made at H. M.'s Mint in Calcutta on coining silver into Rupees.—By COL. J. F. TENNANT, R. E., F. R. S., &c., Master of the Mint,	56

Just Published.

HISTORY OF THE BIRDS OF CEYLON.

PART I.

BY CAPTAIN W. V. LEGGE, R. A., F. L. S.

345 pages, Royal 4to., with 10 plates by Keulemans. To be comple-
ted in two more parts, price £2 each. In this work the geographical range,
habits and nidification of each species is fully worked out.

Intending subscribers should communicate with the author, whose
address is Aberystwith, Wales.

JOURNAL
OF THE
ASIATIC SOCIETY OF BENGAL.

Part II.—PHYSICAL SCIENCE.

No. I.—1879.

I.—*On new species of the Genus Plectopylis of the Family Helicidæ.*—By
LIEUT.-COLONEL GODWIN-AUSTEN, F. R. G. S., F. Z. S., &c., *late*
Deputy Superintendent Topographical Survey of India.

(Received October 7th, 1878;—Read March 6th, 1879.)

(With Plate I.)

Since the paper on the shells of this group of *Helices* was published in the Proceedings of the Zoological Society of London, Nov. 17th, 1874, I have had the good fortune to obtain three new species, one from Tenasserim, among a collection of shells made by Mr. O. Limborg, of which a list is being prepared; the other two are from Eastern Assam. I give a plate, drawn with the aid of the *camera lucida*, shewing enlarged the arrangement of the internal *plicæ*, which differ materially from all those I have as yet examined and figured; these differences form the best of characters by which the species may be determined. Some conchologists may be inclined to doubt the persistence of these internal characters; personal observation is, however, the best means of settling such a point. Having a very large number of *P. brachydiscus*, described below, I set to work and broke open 42 specimens without finding the very slightest variation; of *P. brahma* thirteen were examined with the same result; there is some slight variation in the young, but only in so far that the barriers shew an undeveloped state, the general arrangement being the same. In *P. achatina*, I found perfect similarity in some 12 specimens, and the result has been similar in all other species that I have examined. I think we may therefore feel certain that such internal structures, depending as they do on the form of the

animal, its mantle and secreting organs, will be as persistent as the shell itself, and that their form and relative positions being more complicated and more pronounced than mere outward shape, any divergence in the former is of importance and more noticeable and noteworthy in a specific sense. The animal, I am sorry to say, I have never had an opportunity of examining very closely.

P. shanensis, Stoliczka, (J. A. S. B., 1873, p. 170,) overlooked in my first paper, is I find, the same as *P. trilamellaris*, which I described in the P. Z. S., Jany. 1874, from Burmah, so this last title will not stand. Ferd. Stoliczka's fine collection of shells passed to the Indian Museum, and Mr. G. Nevill compared the two shells and settled their identity. It should be placed after No. 12, *perarota*.

Helix (*Plectopylis*) *brachydiscus*, n sp. Plate I, fig. 1.

Shell dextral, umbilicus very open and shallow, very discoid, rather strong, dull umber-brown, epidermis thick with a cloth-like texture, finely and beautifully ribbed longitudinally, in young fresh shells the upper outer margin is closely set with a strong regular epidermal fringe about 0.75 inches long. Spire quite flat, approaching the concave in some specimens, the apex itself having a subpapillate form. Whorls 7, the last rather flat on the side and angular above, descending at the aperture, which is very oblique and oblate. Peristome strongly reflected, thickened, white, the margins connected by a well raised ridge, notched above and below. A long horizontal lamella is given off from the upper middle portion of this towards the vertical parietal lamina, but only extends for 0.20 inches, then terminates, but at 0.15 inches is again developed, becoming thicker and higher as it approaches the vertical lamina and ending just short of it, in this respect being similar to *P. perarota*.

The parietal vertical lamina is pointed above and gives off from the lower basal end a short lamella towards the aperture, and a very slight short thin, free lamina is to be seen just below the vertical barriers. Palatal teeth simple, six, the 2nd, 3rd, 4th and 5th, are the best developed, the 1st and last are small, 2nd the longest.

Animal not observed.

The measurements of the specimen drawn and of the largest specimen are respectively—

Major diam. 0.82 Minor diam. 0.68. Alt. at axis about 0.24 and
" " 0.95. " " 0.83. " " " 0.28.

HAB.—This shell was found by Mr. O. Limborg on the high range of Mulé-it, east of Moulmein, Tenasserim, and in the neighbourhood. He collected an immense number in a dead bleached state, but only a dozen in a fresh state; the others were, however, exceedingly valuable for proving, as above shown, the persistency of the internal structure in all.

III.—Hemiptera from Upper Tenasserim.—By W. L. DISTANT. Communicated by J. WOOD-MASON.

(Received 22nd Feb. 1879, read 5th March, 1879.)

(With Plate II).

The following paper enumerates and describes the *Hemiptera* collected by Mr Ossian Limborg in the district east of Moulmein, Tenasserim Provinces, and placed in my hands for determination by Mr. Wood-Mason, to whom the insects belong. So little has yet been done in enumerating the Hemipterous Faunas of the East, and this collection is so limited in extent, that it would be futile to attempt any elaborate scheme of tabulation in illustration of geographical affinities and distribution. The publication, however, of the details of such collections as this from a well specified neighbourhood will afford material for such work hereafter. Many of the species, as might be imagined, are common to Northern India, others range through the whole Eastern Archipelago as far as Celebes.

Heteroptera.

Fam. PACHYCORIDÆ.

Chrysocoris grandis, Thunb.

C. porphyricolus, Walk.

Hotea curculionides, H. S.

Fam. HALYDIDÆ.

Dalpada oculata, Fab.

D. varia, Dall.

Fam. PENTATOMIDÆ.

Antestia anchora, Thunb.

Catacanthus incarnatus, Drury.

Prionaea lata, Dall.

Strachia crucigera, Hahn.

Fam. EDESSIDÆ.

Cyclopelta obscura, St. F. and S.

Fam. MICTIDÆ.

Dalader acuticosta, A. and S.

Mictis tenebrosa, Fab.

M. gallina, Dall.

Physocelus calcar, Fab.

P. parvulus, Dall.

Fam. HOMOCERIDÆ.

Homocerus javanicus, Dall.

H. marginellus, H. S.

Fam. ANISOSCELEDÆ.

Serinetia augur, Fab.

S. abdominalis, Fab.

Fam. ALYDIDÆ.

Riptortus pedestris, Fab.

Fam. COREIDÆ.

Acanthocoris scabrator, Fab.

Fam. PYRRHOCORIDÆ.

Lohita grandis, Gray.

Iphita limbata, Stål.

Physopelta gutta, Burm.

Antilochus rufus, Stål.

A. cognobertii, Fab.

Odontopus nigricornis, Stål.

Dindymus rubiginosus, Fab.

Dyoderus cingulatus, Fab.

Fam. REDUVIIDÆ.

- Euagoras plagiatus*, Burm.
Velinus malayus, Stål.
Reduvius mendicous, Stål, var.
Vesbius sanguinorvus, Stål.

Fam. ARADIDÆ.

- Brachyrhynchus membranaceus*, Fab.

Fam. ACANTHASPIDIDÆ.

- Tiarodes versicolor*, Lap.
Sminthus marginellus, n. sp.
Velitra rubro-picta, A. and S.

Fam. GERRIDÆ.

- Ptilomera laticauda*, Hald.
Limnogonus, sp. ?

Fam. BELOSTOMIDÆ.

- Belostoma indica*, St. F. and S.

Homoptera.

Fam. CICADIDÆ.

- Platypleura nobilis*, Germ.
P. insignis, n. sp.
Huechys sanguinea, De Géc.
H. philanata, Fab.
H. thoracica, n. sp.

Scieroptera splendidula, Fab.

- Dundubia mannifera*, Linn.
D. intemerata, Walk.
Pomponia tigroides, Walk. var.
P. sp. ?
Cryptotympana recta, Walk.

Fam. CERCOPIDÆ.

- Cosmoscarta tricolor*, St. F. and S. var.
C. megamera, Butl.
C. masoni, Dist.

Fam. CENTROTIDÆ.

- Centrotypus assamensis*, Fairm.

Fam. IASSIDÆ.

- Tettigonia ferruginea*, Fab.

Fam. EURYBRACHYDIDÆ.

- Eurybrachys (?) punctifera*, Walk.
Ancyra appendiculata, White.

Fam. RICANIIDÆ.

- Ricania guttigera*, Walk.

Fam. FLATIDÆ.

- Cerynia maria*, White. var.
tenella, Walk.

NOTES AND DESCRIPTIONS.

CHRYSOCORIS PORPHYRICOLUS, Walk.

Call. porphyricola, Walk., Cat. Hot., Part. I, p. 29, (1867).

Walker describes this form as being allied to *C. stockerus*, Linn. On the contrary it is very closely allied to *C. purpureus*, Hope, if not even a variety of that species.

SMINTHUS MARGINELLUS, n. sp. Pl. II, Fig. 1.

Sanguineous; head, elytra, lateral borders of sternum and abdomen beneath, and anal abdominal segment black. Antennæ obscure, testaceous; a sanguineous spot behind each eye and base of coriaceous portion of the elytra narrowly of the same colour.

Allied to *S. fuscipennis*, Stål, from which it differs by the very much more robustly developed eyes and the narrower space between them; the head is also slightly more elongated, and the sculpture of the posterior lobe

of the pronotum is different. The colour of the head, extent of the basal, coriaceous patch and the colour beneath also differentiates it.

Long. 18 mill.

PLATYPLEURA INSIGNIS, n. sp. Pl. II, Fig. 2.

Body testaceous, thickly covered with griseous pubescence, Pronotum, mesonotum and metanotum not differing in structure and markings from *P. nobilis*, Germ., but more pubescent; pectus, abdomen above and below also resembling that species. Rostrum with the tip pitchy, reaching a little beyond posterior coxæ. Legs pale ochraceous, fore and intermediate tarsi with the base, apex, and claws pitchy.

Tegmina pale hyaline, with the veins, membrana costæ, area costalis, area radialis (excepting almost apical half) and a large basal patch transversely terminated from near the apex of the lower side of the area radialis and the inner border of tegmina at apex of the lower of the area ulnares, fulvous covered with griseous pubescence. The area radialis is transparent hyaline from about its middle (where it is darker in colour) to near the apex, which is narrowly fulvous and has a subconical fuscous spot on its outer border. A row of small spots on outer margin of the area apicales, situated one on each side of the veins, a submarginal waved row of larger spots situated in like manner, and an irregular series of similar sized spots situated on the bases of the area apicales and apices of the area ulnares, black. The veins in some places are greenish. Wings pale hyaline, with the veins fulvous and a large black basal patch.

♂. Long. ex. tegin. 15 mill.; exp. tegin. 45 mill.

Allied to *P. nobilis*, Germ., but tegmina and wings very distinct, the opaque portion being much less than in that species. The rostrum is shorter in length and the drums do not overlap each other so much as in *P. nobilis*.

HUECHYS THORACICA, n. sp. Pl. II, Fig. 3.

Black, pilose; pile griseous. Face sanguineous with a large triangular sub-basal black spot, transversely strigose and with a deep, central longitudinal impression. Antennæ testaceous with the basal joint black; eyes testaceous, more or less streaked with black (black in a second specimen I have seen). Ocelli, a triangular patch at base of head, the apex of which is situated between the ocelli, a central longitudinal hour-glass shaped fascia extending through whole length of pronotum, abdomen and three large spots on mesonotum, two lateral and one central, sanguineous. Pectus sanguineous with some frontal black markings. Rostrum and legs, black pilose. Tegmina opaque ochreous brown. Wings pale fuliginous hyaline with the nervures dark fuscous.

The rostrum reaches the apex of the intermediate coxæ.

♀. Long. ex. tegm. 19 mill.; exp. tegm. 43 mill.

Two other unnamed specimens of this species are in the British Museum from Hindustan.

POMPONIA, sp. ?

Owing to the number of insects described under the Genus *Dundubia*, frequently only one sex being known, I have considered it better to avoid describing this form until the other and allied genera are structurally monographed.

CRYPTOTIMPANA RECTA, Walk. Pl. II, Fig. 4.

Psidenna recta, Walk Cat Hom I, p. 79, 1850.

Walker's type is a ♀, and I have therefore figured the underside of a ♂ in the collection, which seems to belong to this species. It is much paler in colouration above, being more olivaceous than black, but to this I attach no importance, nor do I to its smaller size. All the other characters agree. The drums are olivaceous inwardly, broadly margined with black.

Long. ex. tegm. 32 mill., exp. tegm. 95 mill.

COSMOSCARTA TRICOLOR, St. F. and Serv. Pl. II, Fig. 5.

Ceroopus tricolor, St. F. and S. Enc. Méth X, p. 604, 1827.

This only differs from the typical form in having the sub-basal fascia represented by a transverse waved series of four sanguineous spots; there is also a spot of the same colour at base. It is thus intermediate between *C. tricolor* and *C. basinotata*, Butl. with the last of which, before expanding the tegmina, I confused it. Butler's form differs also in the colouration of the abdomen. I have called this form a variety of *C. tricolor*, though the term "local race" would be more correct. The difference is certainly not "specific," using that definition in the ordinary sense.

COSMOSCARTA MASONI, Dist. Pl. II, Fig. 6.

C. Masoni, Distant, J. A. S. B., 1878, Vol. XLVII, Pt. 2, p. 194.

Pronotum stramineous, with a quadrate black spot on anterior margin; head luteous; tegmina, pectus, legs and abdomen shining black. Prosternum with lateral borders stramineous.

Face robustly tumid, transversely strigose, with a central impunctate longitudinal impression, eyes prominent, luteous; ocelli distinct, shining, situated at about an equal distance from each other as from eyes; basal portion of the head somewhat pithy. Pronotum thickly and finely punctured, with the lateral margins dilated and strongly reflexed, the lateral angles produced prominently outwards, and the posterior margin rounded, the disc is prominently raised and convex, across the centre of which is a faint impunctate central longitudinal line. The frontal quadrate black patch contains a deep, angular, linear impression on each side behind the eyes, and two small rounded impressions on the posterior border.

Tegmina obscurely and finely punctured; wings dark fuscous with the nervures black. Hind tibiae with a small spine towards apex.

♀. Long. ex. tegm. 17 mill. Exp. tegm. 45 mill.

Greatest long. pronot. $7\frac{1}{2}$ mill. Exp. lat. ang. pronot. 11 mill.

Habitat, Taoo, Tenasserim. Alt. 3—5000 ft.

EXPLANATION OF PLATE II.

Fig. 1. *Sminthus marginellus*, Dist.

„ 2. *Platypleura insignis*, Dist.

„ 3. *Euschys thoracica*, Dist.

„ 4. *Cryptotympana recta*, Walk.

„ 5. *Osmocoarta tricolor*, St. F. and S. var.

„ 6. „ *masoni*, Dist.

IV.—On the Diurnal Variation of Rainfall Frequency at Calcutta.—By HENRY F. BLANFORD, F. G. S., F. Z. S., F. M. S.

(With Plate III.)

[The greater part of the following paper was written some months since in France, and laid before the Society at its meeting in November 1878. In the original paper, the registers of only six years were discussed; but inasmuch as those for twenty years are available in the Meteorological Office, on my return to India, with the permission of the Council, I have withdrawn and recast the paper, including in the data the whole of the existing registers. As might have been anticipated, the inclusion of a period more than three times as long as that originally treated of, has had the result of clearing away some irregularities, and of bringing out more distinctly the true character of the variation; some of the minor features of which were but doubtfully indicated in the original restricted table; while the more prominent features have been confirmed and emphasised. With a view to their more ready appreciation, a plate has been added, which will enable the reader to compare the diurnal variation of rain frequency at different seasons, with the normal diurnal variations of pressure, temperature, relative humidity and vapour tension at Calcutta. H. F. B.]

The tables here summarised are based on the hourly observations recorded at the Surveyor General's Office from August 1856, to March 1877*; during the greater part of the period on the autographic traces of an Osler's anemometer. The form of the reduction does not show the quantity of the rainfall, but only the fact of its occurrence at the several hours specified; in other words, its comparative frequency; and it is possible that the two kinds of variation may not strictly coincide. The traces in question have not yet been reduced for quantity, otherwise than for the total diurnal fall; but the laws of diurnal variation in point of frequency are so salient and decided, that it is hardly likely that any conclusions to which they may lead,

* As published in the Society's Journal.

bearing on the causes that determine precipitation will require serious modification, when the quantity of precipitation is also taken into account. This investigation, I hope to enter upon when the completion of other more pressing matters shall allow of my taking up the enquiry. Meanwhile, the present will, I think, be found a not unimportant contribution to Meteorological Science.

Table showing the Number of Hours in which rain was recorded during 21 years at Calcutta.

HOURS A. M.

	Midn. to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to Noon.	Midn. to Noon.
January,	3	3	5	8	9	8	8	7	8	8	11	10	88
February,	9	9	14	10	11	7	9	12	9	6	13	6	116
March,	7	9	11	8	4	5	7	9	9	11	6	8	94
April,	9	6	7	8	5	5	7	5	5	6	5	5	73
May,	12	14	14	12	12	14	14	11	10	13	18	20	164
June,	65	68	64	55	70	70	73	75	63	81	88	95	867
July,	80	92	94	88	82	95	88	97	102	114	121	135	1188
August,	97	94	94	112	107	109	105	102	103	107	124	133	1287
September,	36	47	65	64	68	57	65	55	48	72	85	86	746
October,	20	26	31	34	37	45	42	44	41	36	42	56	454
November,	2	3	6	8	6	8	8	8	6	6	10	9	82
December,	3	3	4	3	3	3	4	1	3	1	1	2	31
Yearly Total, ..	343	374	409	410	414	426	430	426	409	461	522	565	3189

HOURS P. M.

	Noon to 13	13 to 14	14 to 15	15 to 16	16 to 17	17 to 18	18 to 19	19 to 20	20 to 21	21 to 22	22 to 23	23 to Midn.	Noon to Midn.
January,	5	5	6	6	11	9	6	4	5	5	4	6	72
February,	7	9	7	13	9	9	10	13	8	10	9	6	112
March,	6	7	9	18	18	23	23	28	22	14	12	9	184
April,	7	5	11	25	25	26	24	33	30	23	11	9	229
May,	23	26	27	23	31	53	52	64	57	44	38	16	454
June,	101	89	96	74	83	86	88	86	85	67	66	59	980
July,	152	150	140	119	118	108	100	93	85	56	65	60	1241
August,	126	140	143	119	109	112	91	70	71	77	61	84	1223
September,	107	103	130	115	107	80	80	64	49	38	44	35	951
October,	57	55	64	49	47	32	38	30	31	25	26	25	479
November,	11	10	11	7	8	9	7	7	4	4	4	6	88
December,	1	1	3	2	5	2	2	3	2	0	0	2	23
Yearly Total, ..	603	600	646	571	566	544	521	495	449	361	360	319	6085

From this table, the following conclusions may be drawn. On the average of the year, which average is mainly determined by that of the summer monsoon months, the hour at which rain is least frequent is shortly before midnight, and that at which it is most so, from 2 to 3 P. M. The latter accords approximately with the diurnal epoch of maximum temperature [see Plate III, fig. 6], but the former does not accord with its minimum; and, indeed, the frequency of rain at the hour of mean minimum temperature is nearly 40 per cent. greater than at midnight, while at the hour of its maximum it is only twice as great; and it would rather appear that while the greatest heat coincides with a principal maximum of rainfall, the greatest cold coincides with a secondary maximum. The course of variation as shewn by the table and by fig. 1 of the plate is somewhat as follows:

For about three hours after midnight, the frequency of rainfall increases rapidly, but after 3 A. M. more slowly, till about sunrise; after which there is a slight falling off to a secondary minimum at 9 A. M. This is very distinctly shown in the present table: in that originally drawn up it was less clearly indicated. After 9 A. M. the frequency increases rapidly to the absolute maximum between 2 and 3 P. M. From this maximum it declines, without interruption, to the minimum before midnight. The total number of rainy hours from midnight to noon is 46 per cent. of the whole; and between noon and midnight 54 per cent. On the other hand, in the day time (6 A. M. to 6 P. M.), the proportion is 57 per cent., and 43 per cent. in the night hours.

The character of the variation in the rainy months of the summer monsoon does not differ materially from the above. But that of the hot season is very different; and that of the cold season again differs from both and is more uniform than either. The following table and figs. 2, 3 and 4 in the Plate exhibit the data thus arranged according to the three seasons.

	HOURS A. M.											
	Midn. to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to Noon
<i>Rains</i> : June to October,	298	327	348	358	364	378	373	373	357	410	458	505
<i>Hot season</i> : March to May,	29	29	32	28	21	24	28	25	24	30	29	38
<i>Cold season</i> : November to February,	17	18	29	29	29	26	29	28	33	21	34	27

	HOURS P. M.											
	Noon to 13	13 to 14	14 to 15	15 to 16	16 to 17	17 to 18	18 to 19	19 to 20	20 to 21	21 to 22	22 to 23	23 to Midn.
<i>Rains</i> : June to October,	543	537	572	477	464	418	397	343	321	261	282	263
<i>Hot season</i> : March to May,	36	38	47	66	69	102	99	125	109	81	61	84
<i>Cold season</i> : November to February,	24	25	27	28	33	29	25	27	19	19	17	22

The variation in the rainy months is, then, almost identical with that above described, the chief difference being that after the afternoon maximum, the decline is more rapid. The heavy rains of the monsoon months are, then, more particularly rains of the day time, favoured and accelerated by the diurnal rise of temperature, and declining with the decline of the sun's heat. In a nearly saturated atmosphere, the rapidity with which vapour ascends from lower to higher levels, and eventually becomes dynamically cooled and condensed, depends on the temperature, increasing indeed as the square of the absolute temperature. The relative humidity of the lower atmosphere (as tested in our observations), does not follow the same course of variation. Indeed, as may be seen in fig. 7, this course is exactly the inverse of that of temperature, but as far as can be judged from casual observation, the formation and dispersion of *cumulus* cloud, indicating the state of saturation at heights of from 2000 to 7000 or 8000 feet, is equally determined by the rise and fall of the temperature, and in its mode of formation the rain-cloud of the summer monsoon is essentially *cumulus*. The hour of least frequent rainfall, which in the summer monsoon would seem to be between 10 and 11 P. M., is probably also that of least cloudiness. The hourly variation of cloud is not known for Calcutta, but I found some time since on examining the registers of a number of Bengal stations, at which the cloud proportion had been recorded for some years at 4 and 10 A. M. and P. M. that the average at 10 P. M. was very considerably below that observed at other hours. Kreil has noticed a similar fact at Vienna, and Neumayer in his discussion of the Observations of the Flag-Staff Observatory at Melbourne, also finds that, on the average of the year, there is a strongly marked minimum about this hour. Kreil explains this tendency to the dispersion of cloud, after sunset, by the compression which the lower atmospheric strata undergo, in consequence of the general contraction and subsidence of the mass; to which action he also refers the coincident baro-

metric rise and maximum. In any case, this coincidence of minimum raininess, minimum cloudiness and the semi-diurnal maximum of pressure, is an important fact of observation.

The rapid rise of rain-frequency after midnight corresponds, though less exactly, to the nocturnal fall of pressure; but, as on the average of the year, the secondary maximum is not reached till some time after sunrise, *vis*, about 6 A. M. In the Melbourne curve of cloud variation, this is also about the epoch of the diurnal maximum, and as already remarked it is that of minimum temperature and maximum humidity at the ground surface. The slight fall that ensues continues till between 8 and 9, which is about an hour in advance of the epoch of maximum pressure. It would seem therefore that the tendency to the precipitation of rain is a somewhat complex function of the temperature and pressure variations; or inasmuch as the latter is an effect of the former, of the temperature variation producing two conditions which are in part mutually antagonistic in their effect on the rainfall. To sum up the results of this discussion, I would suggest the following as a possible explanation of the rainfall variation. The cooling of the atmosphere after 3 P. M. in the first place checks the production and ascent of vapour, as well as of convective atmospheric currents, and (adopting Kreil's explanation of the barometric tides) causes a rise of pressure in the lower atmosphere as a consequence of the sinking and compression of the atmospheric mass. These effects bring about a dispersion of cloud and a fall of rainfall frequency from the absolute maximum to the absolute minimum of the 24 hours. About 10 P. M. the compression having reached its maximum, re-expansion sets in, and, in conjunction with continued cooling, raises the relative humidity of the cloud-forming strata, and consequently the tendency to the formation of cloud and rain. When the re-expansion ceases about 3 or 4 A. M., the loss of heat is still operative in the same direction, though less powerfully; but, after sunrise, the direct effect of the solar heat is to diminish cloud and rainfall, while raising the pressure of the lower atmosphere; and it is not until this increasing pressure has nearly attained its maximum, and the ascent of vapour has become sufficiently active to prevail over these first effects, that the formation of cloud* and rainfall proceed actively, and attain their afternoon maximum; this condition coinciding with the highest temperature and the greatest activity of diffusing vapour and convective currents.

This explanation, I must remark, is suggested solely by a consideration of the several coincident phenomena, and presupposes an atmosphere highly charged with vapour, such as is that of the summer monsoon. It would be impossible to predict the course of the changes *a priori*, because the several

* This is of course an assumption as regards the cloud maximum.

actions being to a certain extent mutually antagonistic in their effects on the formation of rain, it would be impossible to foretell, in the absence of direct observations made in the cloud-forming strata, when and how these effects would mutually balance, and in what measure and at what epochs one or the other would become predominant.

In the dry and hot season the diurnal course of rainfall variation is very different from the above. The diurnal epoch of minimum is not very distinctly indicated, but would appear to fall about sunrise. There is, however, but little variation from midnight up to 9 or 10 A. M.; and after this only a slow rise up to 2 P. M., when the increase becomes more rapid. About two hours before sunset there is a sudden rise of about 50 per cent., and the hour of maximum raininess occurs between 7 and 8 P. M., the number of recorded falls being then six times as great as at sunrise. This very striking feature of the hot season is due to the well-known evening storms, commonly called *North-Westers*, which are closely analogous to the thunderstorms of the European summer; and, whether as rain or hail-storms or simply as dust-storms, are characteristic of the dry season more or less in all parts of India. In Lower Bengal they are especially frequent, and the favouring conditions appear to be, the presence of a certain moderate supply of vapour brought by the coast winds, a high temperature at and near the ground surface, and a dry westerly wind from the interior of the country, which in Lower Bengal blows chiefly as an upper current from the plateau of Western Bengal, but during the hottest hours of the day, when it is at its greatest strength, produces a marked effect on the mean wind direction at Calcutta, and is sometimes felt there directly as a hot surface wind. It is when this wind slackens towards sunset, and that from the direction of the coast gains in prevalence, producing a calm in the interval, that North-Westers chiefly occur. They receive their name from the fact that the storm-cloud most commonly originates in the North-West, and advances or rather forms up with great rapidity from that direction, the formation of the nimbus overhead being speedily followed by violent gusts of wind from the same direction, which raise clouds of dust and occasionally exert pressures comparable with those of a cyclone. Immediately before the onset of the storm, the barometer rises rapidly, sometimes more than 0.1 inch; and, as Mr. Eliot has shown from a study of the autographic records of the Alipore Observatory, the subsequent fall coincides with the onset of the stormy winds, and a great and sudden fall of temperature and vapour pressure. Frequent casual observations of the motion of the dust and cloud margin in advance of these storms, have led me to conclude that the stormy wind which blows out from under the storm-cloud is a great horizontal eddy, the impulse of which is furnished by the air dragged down,

Having the weight and fineness of each sample of silver in a pot, we are in a position to compute its fineness on the supposition that no change takes place in melting: this I call the "*Theoretical Fineness*." When the contents are melted and well mixed, a small spoonful of the fused alloy is granulated and from this a muster is delivered to the Assay Master: the fineness of this I have called the "*Fineness of Pot*," it is generally greater than the Theoretical fineness. In the later processes and especially in that of "pickling," preparatory to coining, the fineness is further increased, and the final result is determined from an assay of the coins by taking a proportion of coins for assay singly, and also some for assay after melting them up. This last determination is the least satisfactory; however uniform the melted mixture may be, the alloy is not equally distributed in the resultant ingots and every after process tends to increase this irregularity; so that at last, not only are the various coins different in their fineness, but portions taken from different parts of the same coin are so. I have used as a measure of the fineness of the coins of one day, the mean result derived from 20 single coins—the sample piece being always cut out from the centre of the coin, and I have called the result "*Fineness of Coins*."

During these experiments 10 pots were daily alligated to the same *Theoretical Fineness*: I have thus had a measure of the accuracy of the Assay Reports, and I have used this for calculating the probable errors of the theoretical finenesses, in a way which (though somewhat arbitrary) seems to me sufficiently accurate for the purpose. When the probable error of an Assay Report is known, it is easy to calculate that of one heap, made of several samples of one quality, on the supposition that the whole is fairly mixed. As, however, the mixture must at best be very imperfect, I have preferred assigning to each quality of silver the same probable error of fineness as though all had depended on a single report.

As any erroneous hypothesis as to the quality of scissel used would clearly have vitiated the results, I had a quantity melted down, assayed, and laminated, each pot being kept separate, and thus I had metal which was of known fineness—save the small change from lamination which would equally be shared by all scissel—but which I conceived would be subject in melting to the same changes as scissel itself.

I had intended to keep the work from each pot separate all through, but after a certain point this was found impracticable, and the coins from a single day's melting have been mixed. After I had completed the greater part of the calculation for this paper, I found that, by a careless blunder, there had been a mixing of the coins of the second and third days' meltings; and though I could only prove that it had been slight, and it probably would not have seriously affected the result, I had the work of those days repeated and I use this repetition, though the results are not nearly so accordant as

those I first had. This is the reason why the melting numbers do not run continuously from 89 to 98; 90 and 91 being omitted and 114 and 115 inserted.

The following table shows the mean results for each day's work with their probable errors; the quantities of scissel and copper used daily are approximately shown. The unit of weight is a tolah of 180 English grains. A pot contains close on 12,500 tolahs, or 4687.5 ounces troy, and the whole quantity of standard silver melted and watched was about 12,45,000 tolahs, or 466,875 ounces troy,* or about 14,521 kilograms. What is not accounted for as scissel or copper was refined bar silver of about 997 fine. The scissel was about 916 fine.

Composition.	Fineness in millièmes			Gain in fineness.		
	Theoretical.	of Pots.	of Coina.	Pots — Theory.	Coins — Theory.	Coins — Pots.
{ All scissel, } { No copper, }	915.80 ± 0.078	915.82 ± 0.041	916.34 ± 0.080	0.02 ± 0.088	0.54 ± 0.112	0.52 ± 0.090
{ All scissel, } { No copper, }	915.80 ± 0.058	915.63 ± 0.038	916.35 ± 0.089	-0.17 ± 0.069	0.55 ± 0.106	0.72 ± 0.097
{ 9563 scissel, } { 186 copper, }	916.47 ± 0.079	916.83 ± 0.032	917.40 ± 0.086	0.15 ± 0.086	0.73 ± 0.117	0.57 ± 0.092
{ 10160 scissel, } { 189 copper, }	916.42 ± 0.049	914.36 ± 0.027	917.30 ± 0.085	-0.06 ± 0.056	0.88 ± 0.098	0.94 ± 0.089
{ 7639 scissel, } { 404 copper, }	916.19 ± 0.057	916.75 ± 0.018	917.05 ± 0.078	0.55 ± 0.060	0.86 ± 0.097	0.30 ± 0.080
{ 7612 scissel, } { 407 copper, }	916.20 ± 0.069	916.31 ± 0.019	916.89 ± 0.093	0.11 ± 0.072	0.69 ± 0.116	0.58 ± 0.095
{ 5002 scissel, } { 611 copper, }	915.96 ± 0.066	916.72 ± 0.022	917.07 ± 0.041	0.76 ± 0.070	1.11 ± 0.078	0.35 ± 0.047
{ 5004 scissel, } { 609 copper, }	915.95 ± 0.066	916.80 ± 0.032	917.20 ± 0.077	0.85 ± 0.073	1.25 ± 0.101	0.40 ± 0.083
{ 2591 scissel, } { 526 copper, }	915.71 ± 0.074	916.05 ± 0.018	916.87 ± 0.080	0.24 ± 0.076	1.16 ± 0.109	0.82 ± 0.082
{ 2533 scissel, } { 516 copper, }	915.72 ± 0.074	916.65 ± 0.029	917.28 ± 0.097	0.93 ± 0.079	1.55 ± 0.122	0.63 ± 0.101

It will be seen that two meltings have been made for each proportion of copper. If C represent roughly one hundred tolas of copper, and we group these determinations in proportion to the quantity of copper, we shall have :

Copper.	GAIN IN		
	Pots — Theory.	Coins — Theory.	Coins — Pots.
0 C	$- 0.075 \pm 0.079$	$+ 0.545 \pm 0.109$	$+ 0.620 \pm 0.094$
2 C	$+ 0.050 \pm 0.073$	$+ 0.805 \pm 0.108$	$+ 0.755 \pm 0.091$
4 C	$+ 0.335 \pm 0.065$	$+ 0.775 \pm 0.107$	$+ 0.440 \pm 0.088$
6 C	$+ 0.805 \pm 0.071$	$+ 1.180 \pm 0.090$	$+ 0.375 \pm 0.065$
8 C	$+ 0.635 \pm 0.078$	$+ 1.360 \pm 0.116$	$+ 0.725 \pm 0.092$

It is evident that the refining of the Pots from the Theory is nearly proportional to C, and that the refining of the Coins above the Pots or the ingots is approximately constant, though irregular, as indeed might have been anticipated.

If now we assume $a + mx$ to be the refining in melting, when m is the coefficient of C above, and y to be the refining in passing from the Ingots to Coin; we shall have

5 values of $a + mx$ of nearly equal weight

5 ——— y of sufficiently equal weight

and 5 values of $a + mx + y$, which being the sums of the others we may neglect.

From these equations we get the following values :

$$a = - 0.085 \pm 0.088$$

$$x = + 0.109 \pm 0.018$$

$$y = + 0.588 \pm 0.051$$

The large probable error of a compared with its value renders it very doubtful if there is any real change in scissel melting. What there is seems to be towards *loss of fineness* and it is quite certain that silver evaporates; for, in the Regenerators and flues of the Gas Furnaces (now disused) the soot was found to contain silver.

The other quantities are clearly marked, and the small probable error of x shows that the hypothesis that free copper only burns is probably true. Had a been assumed = 0, the value of x would have been 0.095.

The value of x shows that sufficient copper burns away to raise the fineness by 0.109 millièmes for each 100 tolahs of free copper and this quantity should be added as extra alloy: and the value of y shows that, during the processes of converting ingots into coin, sufficient alloy is removed to make the coins 0.583 of a millième finer on the average than the ingots from which they are made.

Thus in order to have accurate Rupees it would seem necessary that the Calculated or Theoretical fineness of the pots should be

$$916.667 + 0.085 - 0.583 - 0.109 C$$

$$\text{or } 916.169 - 0.109 C.$$

Now if S be the amount of pure silver in a mass and W be its weight, the fineness $f = \frac{S}{W}$ and $dW = -\frac{W}{f} df$.

If in this equation we put $W = 12,500$, $f = 0.916667$ and $df = 0.000109 C$, we shall have dW or the additional alloy = 1.48 C.

Practically then to get Rupees of standard fineness we should alligate to 916.169 and then add $1\frac{1}{2}$ per cent. of the free copper.

For smaller coins the increase of fineness will be greater and the alligation will be lower.

When the alloy in the silver is at all volatile or very oxidable the above rule would not serve of course. So far as possible it is sought to guard against this by melting all low-touch or suspicious silver before receipt and heating it strongly; or even, in some cases, partially refining it.

The probable error of the fineness of the pots for any one day is deduced from 10 reports of as many pots assumed to be alike. Its mean value is 0.0276 of a millième. Hence the probable error of the report of a pot is 0.087* of a millième. As each report is the mean of two single assays, the probable error of a single assay will be 0.123 millièmes.

Again, the probable error of coins used above is derived from 20 single assays of coins; its mean is 0.0806 millièmes, thus the probable error of a single coin assay on the mean of all will be 0.860 millièmes. This probable error is the probable error of a single assay combined with the probable error of a single coin as compared with the mass from which it is taken. The former has been found 0.123 millièmes, hence the latter will be 0.139 millièmes.

Again, it is customary here to check the single assays of coins daily by a double assay of the melted mass resulting from 20 coins spoilt in the stamping presses. The probable error of each such report is combined of the probable error of the mean of 20 coins together with that of a double

* I have assumed that 0.1 of a millième is a sufficient approximation in valuing the Theoretical fineness.

assay, or is 0.116 millième. The usual daily check is one such report from a melting and 10 from single assays of coins, and, as the probable errors of these values are 0.116 and 0.114 respectively, it is evident that they are practically of equal weight: when so taken the probable error of the mean fineness of a day's work will be 0.081 millième.

In receiving Bullion about seven separately assayed parcels make a lac (1,00,000) of Rupees in value. The probable error of an assay report has above been found to be 0.087 millième and that of a lac (in value) of Bullion 3.29 Rupees from assay only. The probable error of a lac of coinage is 8.1 Rupees from its assay, which shows that even for this small daily outturn, the valuation is not sufficiently good; and the uncertainty increases in proportion to the outturn, while that of the intake does not increase so fast.

With 1 lac of outturn the probable error is 2.47 that of equal receipt

2	"	"	3.50	"	"
3	"	"	4.27	"	"
4	"	"	4.95	"	"

In order that the assay valuations of receipt and outturn should be similar, the coinage should be only 63,600 Rupees daily.

If these checks stood alone, it would be impossible for a Mint Master to feel any confidence in his work. And an assay establishment sufficiently large to value a heavy coinage thoroughly, and to make the necessary assays of single coins would be very expensive. The assays of pots are a very valuable test in a large coinage, especially when, as here, they are made nearly uniform in composition and thus check each other. In practice a coin beyond the legal remedy of two millièmes in fineness is almost unknown, but the law is now probably as exacting as it is possible to make it.

I am very greatly indebted to Mr. Edis, who was acting as Assay Master of this Mint, for the attention and skill he gave to these assays, which were more in number than the amount of work ordinarily would have called for. The accuracy of his work is proved by the small probable errors.

To obtain these data was the primary object of my experiments: incidentally, however, the weighments which are made in passing the metal from hand to hand furnish some interesting information as to the general working of the Mint which I purpose here to place on record.

The unit of weighment is a tolah (the weight of a standard rupee) of 180 grains, which is here decimally divided: 8 tolahs are equivalent to 8 ounces Troy; the English Pound contains 88.88889 and the kilogram 85.73526 tolahs. And hence—

1,00,000 Rupees should weigh 1,00,000 tolahe.
 " 87,500 ounces Troy.
 " 2,571·4296 Pounds = 1·14796 Tons.
 " 1,166·8811 kilograms.

The Melter receives his silver in bars and lumps, and also as scissel and rejected blanks and coins. The portions for each pot and its proportion of copper are separately delivered. His results are—

1st.—Ingots which can be weighed as soon as cleaned.

2nd.—Chippings from the bars and spillage which require to be cleaned before weighment: usually next morning.

3rd.—Ends of ingots and pieces cut off before delivery to the laminator as not being fit for straps.

4th.—He has drosses and sweep which contain more or less silver and of which the value cannot be known till later.

The following table shows the results obtained in this department from these experiments, as to which it must be noted, that while the metal is accurately weighed to the Melter, the future weighments are less accurate until it takes the form of coin, for it would be impossible to give the same time and care to weighments which are mere checks that are necessarily given to the more important ones; or to use balances for them as delicate.

Me'ting No.	Weight given to Melter.	Outturn.			Approximate Loss.
		Good Ingots.	Heads and Pieces.	Particles.	
	<i>Tolahe.</i>	<i>Tolahe.</i>	<i>Tolahe.</i>	<i>Tolahe.</i>	<i>Tolahe.</i>
89	119,447·0	118,908·8	0	461·2	77·0
92	125,148·0	124,573·6	0	505·4	69·0
93	125,121·0	124,667·8	0	357·5	95·7
94	125,076·0	124,557·8	0	420·8	91·4
95	125,090·0	124,642·6	4·0	398·0	55·4
96	125,133·0	124,676·8	0	387·4	68·8
97	124,023·3	123,114·8	103·0	754·5	51·0
98	124,530·0	123,496·4	531·0	442·4	80·2
114	125,434·0	124,691·2	280·0	366·2	96·6
115	125,973·0	125,480·4	0	423·9	68·7
Sums.	1,244,975·3	1,238,810·2	918·0	4513·8	733·8
Percentage.		99·60480	0·07874	0·36252	0·05894

Hence it will be seen that about $4\frac{1}{2}$ per cent. alone of the weight is unaccounted for at once, and that, after the particles are all recovered, the amount left in the drosses is about 6 parts in 10,000, and this includes the alloy burnt away. At the rate of $1\frac{1}{2}$ per cent. on the free copper, the loss on that metal would have been 607·2 tolahs, leaving only 128·6 tolahs or 0·010169 per cent. of the value as a real loss, but what is shown above fairly represents the experience of some years as regards the net loss of weight by burning.

When passed by the test of assay, the ingots go to the Laminating Department, and from this time no trustworthy valuation can be made till the coin is ready for issue. In all the succeeding processes metal is lost by abrasion and by alloy being burnt in the annealing processes and removed in the pickling necessary to clean the surface of the silver for stamping. On the other hand, oil and grease from the machinery adhere to the surfaces and (till the blanks are cleaned) a small portion of oxide adheres and thus the weight is increased.

It will be seen from the following table that the Laminators cut off and reject about 2 per cent. of the metal received, and that, very little weight being apparently lost, the outturn of good blanks is nearly 60 per cent. of the weight of ingots. Good blanks here of course meaning those which are perfect in form and ready to be tested as to their sufficiency in weight. When the whole sweeps have been refined and the silver in them recovered, there is ordinarily a gain in the Laminating Department from the causes I have spoken of. It appears that in a mean of several years the result of crediting the recoveries of sweep &c., has been a small gain in weight in these Departments, amounting to 0·00003 of the amount. It is here that the effect of bad silver is mainly felt: when silver which is derived from ornaments, and a few other sources, is used without being well refined, the floors of the laminating rooms are covered with spangles, causing of course a heavy loss, and the edges of the straps are ragged, so that the outturn of blanks is much less than the normal amount, while the weight of scissel is sensibly increased.

No. Melting	Weight of Ingots.	LAMINATING.			FINE ROLLING.			CUTTING OUT BLANKS.			
		Good straps.	Ends and pieces.	Loss.	Good straps.	Loss.		Good Blanks.	Bad blanks and pieces.	Scissel.	Loss.
	<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>		<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>	<i>Totals.</i>
88	118,908.8	116,565.0	2,328.3	15.5	116,558.1	6.9		69,639.4	418.2	46,445.7	5.3
92	124,573.6	122,837.5	2,225.5	13.6	122,833.6	3.7		73,944.0	310.3	48,071.5	+ 8.0
93	124,687.8	122,707.1	1,963.8	2.1	122,704.6	2.5		74,186.2	265.6	48,240.8	+ 12.0
94	124,557.8	122,320.0	2,222.2	15.6	122,316.2	3.8		73,856.7	207.7	48,156.3	— 4.5
95	124,642.6	122,366.3	2,241.1	15.3	122,385.2	1.1		73,946.4	223.9	48,202.1	+ 7.6
96	124,676.8	122,368.9	2,298.4	14.5	122,363.3	5.6		74,110.1	228.5	48,025.4	+ 1.3
97	123,114.8	120,952.8	2,151.6	10.4	120,960.7	2.1		73,381.0	314.5	47,267.5	— 12.3
98	123,496.4	121,114.2	2,356.4	25.8	121,113.9	0.3		72,747.4	254.5	48,105.9	+ 6.1
114	124,691.2	122,230.3	2,448.1	12.8	122,226.1	4.2		73,075.5	585.1	48,618.8	+ 3.3
115	125,490.4	123,011.4	2,450.2	18.8	123,009.1	2.3		73,631.5	856.1	49,029.6	— 8.1
	1,288,810.2	1,215,938.5	22,676.6	140.1	1,215,961.0	32.5		732,678.2	3117.4	480,163.6	+ 1.6
Percent- age	{ of Ingots, of Receipts,	98.15318	1.83051	-0.1131	98.15556	0.00262		59.14370	0.25164	38.76007	0.00014
					99.99752	0.00267		60.25507	0.25638	39.48841	0.00014

The blanks when cut out pass to an officer whom we call the Adjuster whose duties are very important. After being slightly cleaned the blanks are individually weighed in Automatic Machines, the light blanks are returned to the melting pot, while those that are too heavy have their weight reduced. This used to be done by hand, but we have recently made a machine which deals satisfactorily with about 1500 blanks an hour. As the farther processes of coining reduce the weight of the blanks, an allowance has to be made here for this reduction, and it is part of the adjuster's duty not only to keep his machines in order and see that each blank is within the remedy allowed, but further to check the weights of the bags (each containing 2000 blanks) and see that each bag is within the much narrower limit laid down for his guidance, and that finally even then they are not all on one side so that the error would accumulate.

Melting No.	Tale of Blanks.				Delivery to Milling Dept.	
	Received.	Heavy.	Medium.	Light.	Tale.	Weight.
89	69,662	2,965	63,933	2,764	66,000	66,035.9
92	73,890	2,617	68,928	2,315	70,000	70,042.5
93	74,124	3,086	68,790	2,248	70,000	70,045.0
94	73,906	2,416	69,283	2,207	70,000	70,044.0
95	73,896	2,009	69,959	1,928	70,000	70,044.6
96	74,056	1,420	71,277	1,359	72,000	72,045.4
97	73,300	3,143	67,971	2,186	70,000	70,044.1
98	72,684	2,744	68,232	1,708	70,000	70,044.1
114	73,024	3,028	67,783	2,213	70,000	70,045.5
115	73,582	1,430	70,847	1,305	70,000	70,045.5
Sums.	732,124	24,858	687,003	20,263	698,000	698,436.6
Percentage.		3.39633	93.83697	2.76770		

The proportion of light and heavy blanks beyond remedy is about what has now for many months been usual: the Tale of Blanks sent on is smaller in proportion, and I have not thought the percentage worth giving. Of course it includes heavy blanks reduced, but only whole bags are sent on, and thus not only has the percentage sent on been smaller but it is more regular than usual: I believe too that the weight is more regular.

The experiments were not sufficiently extensive to show the working of the machine for reducing blanks, but the following data will show this and give a comparison with the old method of filing by hand.

In December 1878, 283,639.9 Tola's of blanks were reduced by machine to 282,866.5

Silver removed 1,272.4

The recovery was 1243.4 Tola's of particles worth 1173.61 Rs., showing a loss of 2.856 per cent. in weight of particles and 7.884 " " in value of the silver

In December 1877, 233,849·8 tolahs of blanks were reduced
by filing to 232,049·4

Silver removed 1,800·4

The recovery was 1223·7 tolahs of particles worth 1129·28 Rs.,
showing a loss of 5·898 per cent. in weight of particles
and 18·236 „ „ in value of silver.

The accuracy with which a certain amount can be removed per bag has
been increased and the cost greatly decreased, for one boy can attend on
two machines reducing, if needed, 21,000 blanks a day, whereas this used to
require ten men, and as so many were not always available, work often fell
into arrears.

I have now to trace the blanks through their last stages till they be-
come rupees.

The adjuster passes on the blanks to what is here called the Milling
Department, but in the Royal Mint the work is called Marking. In this
process, a few blanks are spoiled when the setting of the machines is
defective. The final annealing and pickling come next, and the rupees
lastly issue from the Stamping Press, only requiring examination before
final issue.

I have not thought it worth while to give here the separate results in
the rooms devoted to these purposes severally. Defects in the Milling De-
partment and those in the annealing sometimes pass till they are found out
in the presses or in the final scrutiny.

	Blanks from Adjuster.		Rupees fit for issue.		
	Tola.	Weight.	Tola.	Weight at rate of receipt.	Weight after coinage.
		Tolabs.		Tolabs.	Tolabs.
89	66,000	66,035·9	64,832		64,834·0
92	70,000	70,042·5	67,940		67,943·9
93	70,000	70,045·0	68,956		68,961·9
94	70,000	70,044·0	69,005		69,007·8
95	70,000	70,044·6	67,910		67,911·6
96	72,000	72,045·4	70,459		70,458·6
97	70,000	70,044·1	67,738		67,735·8
98	70,000	70,044·1	68,507		68,506·6
114	70,000	70,045·5	68,058		68,057·4
115	70,000	70,045·5	68,407		68,411·6
Sums.	698,000	698,436·6	681,812	682,223·4	681,629·2
Percentage of blanks.			97·68080	Loss of weight in work. „ 34·3	

We have already seen that 59·1437 per cent. of the weight of ingots is converted into blanks. These were in tale 732,124, of which 687,008 were good and 24,858 heavy but capable of being reduced, or in all 711,861 capable of being coined, and we now find that of those sent on from the Adjusting Room 97·68080 per cent. become good Rupees. If then, all had been sent on we might have expected 695,351 good coins whose standard weight would be 56 131 per cent. of that of the ingots.

Further, we find that 681,812 blanks as they leave the adjuster lose in after processes 394 2 tolahs, or 70,956 grains, in weight. Thus the average loss on each is 0·10407* grains, and each blank leaving the adjuster should on an average weigh 180·10407 grains, and each bag of 2000 blanks 2001·156 tolahs.

The general procedure of Minting has been unchanged for very many years, but, as the effects of the coining processes must vary with details of manipulation impossible to define exactly, I some time ago recognized that it was necessary to modify both the amount of additional alloy and the excess weight of the blank over the coin, and resolved to investigate the matter.

I now offer these results to a wider circle than they were originally meant for, because I think that many will be interested in knowing the care that is taken to keep the coinage of India to its standard value. I hope too that it may lead to the publication and circulation of similar results from other Mints and thus to advance in Minting.

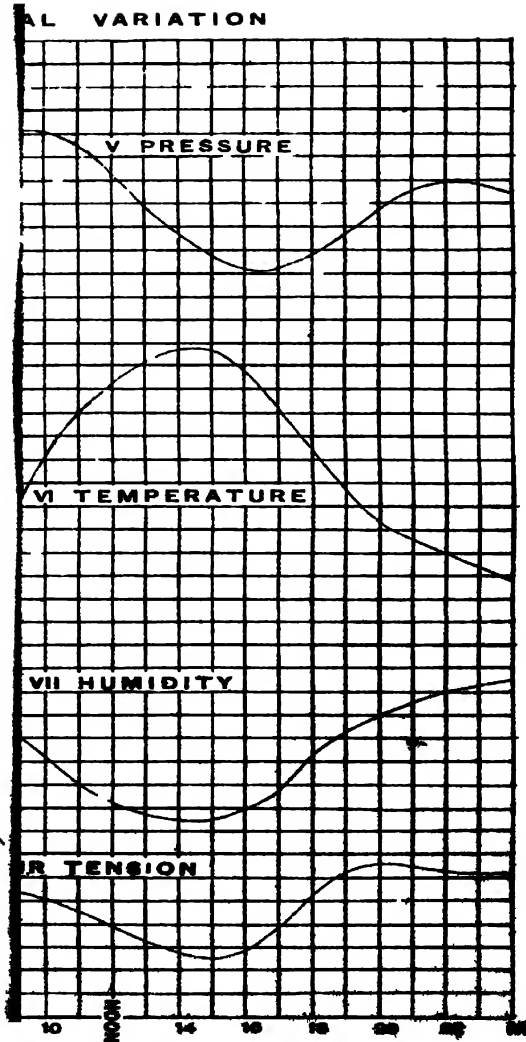
* This amount, like the y of the fineness (see note p. 60), varies with manipulation and the quantities are dependent on each other.





Fig. 100 dal et lath

TFNASSFRIM HEMIPTERA



Expd. at the Surveyor General's Office, Calcutta.

CONTENTS

OF THE NATURAL HISTORY PART (PT. II.) OF THE JOURNAL OF THE ASIATIC SOCIETY OF BENGAL FOR 1878.

No 1, (issued May 24th, 1878). *Description of Raticilla schisticeps* *Hodge*—By W T BLANFORD. *Aberrant Dentition of Felis Tigris*.—By R LYDEKKER. *Record of the Occurrence of Earthquakes in Assam during 1877*—Communicated by COLONEL R. H. KEATINGE. *Sixth List of Birds from the Hill Ranges of the North-East Frontier of India*.—By MAJOR H. H. GODWIN-ALSTEN—*An Account of the Tidal Observations in the Gulf of Cutch, conducted by the Great Trigonometrical Survey under the superintendence of COLONEL J. T. WALKER*. *Compiled from the G T Survey Reports by CAPT. J. WATERHOUSE.*

No 2, (issued July 10th, 1878) *The Application of Photography to the Reproduction of Maps and Plans by Photo-mechanical and other processes*—By CAPT J WATERHOUSE, (with one Plate).

No 3, (issued Oct 28th, 1878) *Notes on some Reptilia from the Himalayas and Burma*—By W T BLANFORD. *Notes on the Earthquake in the Punjab of March 2nd, 1878*—By A. B. WYNNE. *Notes on the Land and Fresh-water shells of Kashmir, more particularly of the Jhelum valley below Srinagar and the hills North of Jammu*—By W. THEOBALD. *On some Mammals from Tenasserim*.—By W. T. BLANFORD, (with three plates) *List of Hymenoptera obtained by OSSIAN LIMBORG, east of Maulmain, Tenasserim Provinces, during the months of December 1876, January, March, and April 1877, with descriptions of new species*:—by F. SMITH. *Communicated by J. WOOD-MASON* *Preliminary Diagnoses of new Coleopterous Insects belonging to the families Dytiscidae, Staphylinidae, and Scarabaeidae, obtained by the late F. STOLICZKA during the 2nd Mission to Yarkand under SIR DOUGLAS FORSYTH*.—By D. SHARP.

No. 4, (issued April 6th, 1879). *Description of a new Lepidopterous Insect belonging to the genus Thaumantis*.—By J. WOOD-MASON. *Great Snow-fall in Kashmir*.—By R. LYDEKKER. *Physiographical Notes on Tanjore (Tanjá-úr)*.—By LT-COL. B. R. BRANFILL, *Deputy Superintendent, Great Trigonometrical Branch, Survey of India*. *Communicated by COLONEL J. T. WALKER*.—*On the proper relative Sectional Areas for Copper and Iron Lightning rods*.—By R. S. BROUGH. *Description of a New Homopterous Insect belonging to the Genus Cosmocarta*.—By W. L. DILLARD. *On the Indian Species of the Genus Erinaceus*.—By J. ANDERSON. *Description of a supposed new Hedgehog from Muscat in Arabia*.—By W. T. BLANFORD. *On Articola indica, Gray, and its relations to the Sub-Genus Neoskia, with a description of the species of Neoskia*.—By J. ANDERSON.

CONTENTS.

	Page
VII.— <i>The old Burmese route over Patkai vñ Nongyang (the most feasible and direct route, from India to China).—By S. E. PRAL, ESQ., (with 2 maps and 2 plates), ..</i>	69
VIII.— <i>On a new Standard of Light.—By LOUIS SCHWENDLER, (with plate),.....</i>	83
IX.— <i>A second note on Mammalia collected by Major Biddulph in Gilgit.—By W. T. BLANFORD, F. R. S., &c,</i>	95
X.— <i>A Description of some new Species of Hydroid Zoophytes from the Indian Coasts and Seas.—By SURGEON J ARMSTRONG, Marine Survey Department, (with 4 plates),....</i>	98
XI.— <i>Notes on the Formation of the Country passed through by the 2nd Column Tal Chotials Field Force during its march from Kala Abdullah Khán in the Khójek Pass to Lugári Bárhán. Spring of 1879.—By LIEUT. R. C. TEMPLE, 1st Ghorkas, (with a map),</i>	108
XII.— <i>Notes on a collection of Reptiles and Frogs from the neighbourhood of Ellips and Dumagudem.—By W. T. BLANFORD, F. R. S., &c., ..</i>	110
XIII.— <i>Preliminary Notices of a new Genus (Parectatosoma) of Phasmids from Madagascar, with brief Descriptions of its two Species.—By J. WOOD-MASON,</i>	117

Just Published.

HISTORY OF THE BIRDS OF CEYLON.

PART I.

By CAPTAIN W. V. LEEGE, R. A., F. L. S.

345 pages, Royal 4to., with 16 plates by Knapemann. To be completed in two more parts, prices £3 each. In this work the geographical range, habits and nidification of each species is fully worked out.

Intending subscribers should communicate with the author, whose address is Aberystwyth, Wales.

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

Part II.—PHYSICAL SCIENCE.

No. II.—1879.

VII.—*Note on the old Burmese route over Patkai viâ Nongyang (viewed as the most feasible and direct route, from India to China).—By*
S. E. PEAL, Esq.

(Received 12th March, read 2nd April)

(With Plates IV, V, VI, and VII).

Perhaps in no other part of the world can be found a parallel to the small and peculiar region immediately East of Assam, and that separates India from China.

On each side of it we see a large Empire, numbering its people by hundreds of millions, densely located, and who have been for many centuries conspicuous for their industry and intelligence, and with records extending far into the past.

Yet across this interval of some 200 miles only, we find little or no intercourse or trade.

Undoubtedly towards the North and North-East, the difficulties of finding an outlet at any reasonable elevation are demonstrated. In most cases the routes must cross at least 10,000 feet or more, besides being proverbially difficult.

Assam has never to our knowledge been entered by any large force from the North East, or due East, and the only invasions, (excepting those up the valley from the west) have been over Patkai, by the Ahoms and Burmese.

The discovery of a good trade route between India and China, has long exercised many minds. Routes *vid* lower and upper Burma, to Yunan, have been of late years advocated and partially tried, but all present a consistent feature in the extreme difficulty of the country beyond a certain point.

The experience of the Grosvenor Mission clearly confirms this, and indirectly points to the necessity of crossing the intervening valleys higher up—(the country between Momein and Yunan being reported extremely difficult).

Keeping these facts in view, a few remarks regarding the old route out of Eastern Assam, *vid* Patkai, and the possibility of a good trade route with western China, *vid* the Sittang country to the Yang-tse-kiang, may be of some interest.

Some years ago attention was directed to this route and endeavours made to induce Government to explore it.

In 1868 Mr. F. A. Goodenough of the Calcutta Chamber of Commerce submitted a report to Government for co-operation in the matter, urging that the time had come when such an expedition was advisable and likely to be a success. The local authorities, however, viewed the proposition with such marked coldness, that no action was taken in the matter.

In 1868 Mr. H. L. Jenkins crossed the Patkai near the head waters of the Namrúp river, discovering the Nongyang lake on the other side, but he was unable to proceed further that year.*

In 1869 he again started in company with Mr. A. J. Peal, and followed the track of the previous year, and passing the Nongyang lake, found no serious obstacles until they reached the first Singphú villages at Númyúng in the Húkong valley,† where advance was prohibited by the chiefs.

After fruitless attempts to overcome their opposition, the party was compelled to return to Assam, selecting the route by which Dr Griffiths passed from Assam to Burma in 1837, and which is more to the west.

By the route in, the line generally was both more circuitous and difficult.

Remarking on the latter Mr. Jenkins says, "It is much to be regretted that Griffiths chanced to take this route, for it is doubtless owing to his description, that a general impression has arisen that the Patkai range is a formidable barrier erected by nature to prevent communication between India and the countries lying to the East."

Having been more carefully and recently described than the others,

* See Proceedings A. S. B. 1869, page 67.

† See Proceedings A. S. B. July 1870, page 230 *et seq.*

"Griffith's route" has come to be taken as a type of the difficulties on this question, and has undoubtedly led many into error.

Tracing the subject back, we find that in 1816 some 6,000 Burmese troops and 8,000 auxiliaries crossed Patkai into Assam, at the invitation of the Raja (Chandrakant).

Soon after, it is said, 80,000 followed under Keo Minghi, who returned to Ava in 1818, leaving about 2,000 men behind him in Assam.

About 1821 Maha Thilawa, the Burmese general in Assam, was involved in disputes with us, and in 1822 Menghi Maha Bandula led 18,000 men over Patkai and made Assam virtually a Burmese province.

In 1824, war was declared by us, and the question of routes into Burma was eagerly discussed. Four were declared practicable, two by sea, and two by land, *i. e.*,

Land route, Calcutta to Ava <i>via</i> Assam,	1,488 miles and 170 days.
" " " Manipur,	1,052 " " 107 "
Sea route, " " <i>via</i> Aracan,	835 " " 39 "
" " " Rangún,	1,446 " " 82 "

Of the land routes, it was settled that the line *via* Assam, and over Patkai was by far the best, but that *via* Rangún offering better transport for stores was ultimately adopted.

In 1828, Lieut. Burnett reported on the route by which the Burmese had entered Assam, and it was no doubt on this that Pemberton relied in his "Report on the N. E. frontier" in 1835.

"The passage of the Patkai," he remarks, "is represented as easy "when compared to the seven or eight equally lofty ranges that must be "crossed between Cachar and the Munipuri valley."

On all occasions Pemberton wrote in high terms of this pass, and, after his surveys on the Munipuri side, we may consider him one of the best authorities on the matter.

Sir Ashley Eden has truly said that no man before, or since, has ever had such opportunities of collecting reliable information on the subject, and very few would, or could, make such good use of them.

It was in 1837 that Dr. Griffiths, who was one of the Tea Commissioners, crossed from Assam to Ava. Yet though he started from Bissau, and passed Maikwan, his route over that portion nowhere coincided with Pemberton's account of the old Burmese one.

After leaving Bissau, in Assam, he took a considerable detour to the west, the reason for which is not I think to be found in his journal, but is attributable to the fact that along the old route villages were maintained, so that not only was the route itself always kept more open and in repair, but provisions obtainable all along.

Whether these villages were kept there by the authorities or remained there of their own choice, and benefitted by the line of trade we cannot now say, but soon after the close of the Burmese war, they migrated westwards; possibly the state of frontier anarchy that followed left them too often at the mercy of necessitous soldiery, to avoid whom they retreated to the higher ranges.

On Griffiths' arrival, therefore, at Bisa, instead of pursuing the old route up the Namrúp river, towards the Loglai basin, we find he made a sudden turn westward and passed through the "Morang Nága" country, crossing Patkai near Yugli at 5,000 feet elevation, and subsequent ranges at 3,500 and again 5,100 feet, Nongyang lake being left fully 20 to 25 miles to the east.

The old route, in fact, at that time had been abandoned—neither food nor transport could be got there—and he was compelled to go where these were obtainable; the old path also by that time would have been covered by jungle and more or less impracticable.

Properly speaking the name Patkai applies only to the highest ridges wherever they occur; in few places are they continuous for any distance; the water parting is often cut up into distinct groups of hills with many low places intervening, more especially towards the eastwards, where from the Nongyang lake, they sink lower and lower, to where Singphus assert they have crossed nearly on the level after Rhinoceros.

It is in this neighbourhood that Mr. Jenkins and others consider it extremely likely that passes may be found at even less than 2,000 feet elevation, and it is evidently near here that the old route lay. The basins of the Namrúp on the north and Loglai on the south, so closely approach each other from opposite sides, as to leave but *one march* between them from water to water.

These two drainage basins, shewing as they do the lowest levels on each side to be in such close proximity, and where the soft strata is most rapidly denuded, naturally indicate the lowest part of the range.

Pemberton describes the old route as follows:

"Bisa, which is the principal village and residence of the head of the Singphu tribe of that name, stands about 10 miles from the gorge of the defile through which the pass leads, and the first stage is to the Namrúp Nulla, on the banks of which good camping ground is found 16 miles from Bisa.

"Between the 1st and 2nd stages two hills are crossed, the Tontúk and the Nunnun, neither of which present any difficulties that might not be easily overcome. The Namrúp flows between these hills, and the Nunnun* falls into it a short distance from the second encampment;

* Namphúk.

"there is but little jungle in the vicinity of the camping ground, which has space for a tolerably large body of troops.

"The distance of this stage is 12 miles.

"The third stage, which extends from the Nunnun to the Kasi Nulla, flowing at the northern foot of the Patkai hill, is about 7 miles.

"After leaving the Nunnun and crossing a low hill, the Namrúp is again reached and its bed travelled over for 5 miles.

"This portion of the route is the worst, as the bed of the nulla is filled with large stones and rocks over which the traveller finds it difficult to make his way, but the Burmese appear to have avoided it by cutting paths through the forest above.

"From the Kasi Nulla to the summit of the Patkai central ridge, the distance is about 4 miles, and the ascent is said to be very precipitous, but it is quite evident from the description given, and the manner in which the Burmese travelled that there are no serious obstacles which the judicious employment of a few pioneers would not readily overcome. From the Kasi Nulla at the northern foot of the Patkai hill across to the Loglai the first nulla met with on its southern declivity is one long march, and there is said to be a very inadequate supply of water between these two streams.

"From the Loglai to old Bisagaun, the original site of the Singphu tribe, not far from the gorge of the pass on the southern or Burmese side, there are six marches none of which are either very long or difficult."

In the above quotation from Pemberton it is noteworthy that the first two, if not three, marches coincide with the route taken by Mr. Jenkins *vid* the Nongyang lake in 1869.

Both follow the Namrúp for some distance and then leave it where the river makes a long detour to the east, and near to the village of Namphúk, and thence crossing some low hills, descend again to the river, thus cutting off a large bend.

After this, even, it is evident that the routes coincide, and where they diverged it is not now easy to find.

It is extremely probable that the old Burmese route that Pemberton describes, lay a little to the east, for though Mr. Jenkins states they could have crossed the ridge some 500 or 600 feet lower, by keeping more west, yet the ranges to the eastwards are generally *still* lower.

From the foregoing it is obvious that the old route held longer to the basin of the Namrúp, and debouched on the Loglai higher up, thus escaping Digum Búm; the two routes, however, are near each other, and fairly direct, which Griffiths was not, but it is only by a careful study of the locality

that the best site could be found, all is now forest, and the route line will have to be re-discovered; there can however be little doubt that it crossed Patkai close to this point, and probably at less than 2,500 feet above the sea level, and say 2,000 feet on the spot.

The approaches to Patkai at the part indicated, present no insuperable difficulties on either side; undoubtedly a strip of hilly country extends for some distance north and south, parallel to the main range or ranges, but the country on the northern flank consists of tolerably low hills and rolling land, and on the other side, it seems to be repeated between Digumpáni and the Turong

The paths on that side, in fact, are now confined mainly to stream-beds between which they cross low spurs; the latter is characteristic of the route between Loglai and Namyung, where it goes by the Kaisu, Namlip, Yúngsúm, and Yungmoi, to the village of Númyúng in the Húkong, or Dinci, valley.

It is unfortunate that ever since our taking possession of Assam most works that allude to routes between India and China, treat the passage of these ranges as an almost insuperable obstacle.

Excepting by Pemberton, and latterly Mr. H. L. Jenkins, it is generally looked on as a subject hardly worth discussion, or investigation.

It is taken for granted that there is no good, or even fair, route from Assam *via* Húkong to the Shán States, and that the Patkai is simply an impassable barrier, whereas the truth is that the more the matter is investigated the more likely it appears that this old route will turn out to be not only the best, but perhaps the *only* available trade-route out of upper Assam, by which we can get anywhere *East*.

From the summit of Patkai, near where the old route crossed, the view south-west is across a rather large triangular valley having a sheet of water in it called "Nongyang" several miles long, and a wooded island towards the eastern extremity. The "Nongyang River" falls in from the west after a course of 12 or 14 miles, mainly between two high and continuous ridges, each called Patkai, that were crossed by Drs. Griffiths and Bayfield, and which river has generally been considered the boundary between Assam and Burma at this part. After passing through the lake the river flows out east into the Loglai, or Laklai, going south and east to the Turong.

On the south, Digam Bám rises very conspicuously beyond the Nongyangpáni; it is probably not less than 3,000 to 4,000 feet high, the surrounding hills north and south being 2,000 to 3,000, with water-courses and passes at perhaps 1,000 feet above the sea level.

Beyond Digam Bám lie the first Singphú villages in the Húkong

valley, the nearest being Númyúng, situated on a river of the same name that rises far to the west, south of Patkai and nearly opposite the Tirap valley (of the northern slope).

The name of this river has been so variously rendered as to make its recognition at times difficult; we find it as the Ramyoom, Kamyoom, Kammiroan, Nam-ma-ron, and Námyúng, the latter no doubt most correct. After passing the village it flows S. E. and falls into the Túrong. From Namyung there is constant intercourse with the south, west, and east, over an undulating but not difficult country. Traders generally pass it on route for Assam.

It is extremely significant that the name "Patkai" (which is an abbreviation of Pat kai song kan*) originated on the pass at the part above indicated, in consequence of an oath there ratified between the Ahom Raja "Chudangpha"† on the north side, with Súrunphai, the Nora Raja of the south side, whereby each bound themselves to respect the Nongyang-páni as the boundary, and that between them, ere separating, they erected two sculptured monuments, as memorials of the treaty on each bank of the river.

Previous to this period the range there was called "Doikaurang" Doi = Mountain, Kau = 9, and rang = united, namely the place of "nine united hills," or where nine ranges converge, which latter singularly confirms all we know of the place already.

At the site in question, but one range is crossed from water to water, whereas to the west, at least 8 or 9 conspicuous ridges must be crossed ere the plains are reached beyond.

The name "Doikaurang" was bestowed by the first Ahom Raja "Chukhapha," when passing from Nora, or Pong, to take Assam in 1228 A. D.

It seems clearly demonstrated by this time, that there are no trade routes to be expected *vid* the "Brahmakund," the "Daphapáni," or "No Dehing" valleys, and nothing intermediate is possible.

The sufferings of Lieut. Wilcox and his party in 1827-8 during his attempts to penetrate eastwards are sufficient to deter any re-surveys of those routes for such a purpose.

The Mishmi hills to the north again, or the Abor country, are equally uninviting, nor are lines of traffic more likely through the Daphla hills, except by cattle, and over passes that on the north, as on the east, are not less than 10,000 feet, if as low.

* Pat = cut, Kai = fowls, Seng = oath, Kan = taken.

† Chudangpha's ambassador was the Bor Gohain Tintanbing, and that of the Nora Raja, Tadinpou, date 1399-40 A. D.

To the south-east, even if a little too far south, must we turn, if anything approaching a trade route out of Assam is to be found, and at or near the old Burmese route, we at once get one that is remarkably easy and that with comparatively little outlay would be suitable for wheel traffic.

The station of Gauháti on the Brahmaputra, is now connected by a fine carriage road to the Shillong plateau, which rises to between 5,000 and 6,000 feet, the last 3,000 feet of which is in a distance of only 12 miles.

The difficulties of crossing Patkai are, at least, *less than half* of those met with on such a road, and that we can easily overcome them we have demonstrated.

Having glanced at the position of the route *viâ* Nongyang, it may be well to indicate those of several others, leading from upper Assam into before noted, the valley of Hukong.

There is a route through the Nága hills west of the Tirap river, and east of the Disang, that enters at the Namsang Nadi, a tributary of the Dihing, and not far south of Jaipur. This line after traversing the bed of the Namsang for some distance crosses the Patkai by the Takum pass, (say 5,000 feet) and thence follows the Namyung till it joins Griffiths' route (the latter is often called the Tirap route).

A second entrance to this same Takum route is from Borhát on the Disang river; the water-shed about here, though, rises to 6,000 and 7,000 feet and is a more continuous ridge.

The late Colonel Hannay advocated a line *viâ* Bhiton Namsang on the Tankak river in the Sibságar district, passing through the Nága villages of Sangloi, Sangsa, Sangba, Langia (or Longra), Horu Khet, and Chotagaon to Singolani, the latter situated on the Dinoi some 45 miles north and 30 west of Munghhong, and near the western extremity of the valley of Hukong. This line presents no very serious obstacles and is much used.

Another route has been proposed entering the Dhansiri valley, passing Samaguting, and thence *viâ* Phre re ma, Gopsi ma, Dibú ma, Teseshu ma, Tajoga ma, Kaza ma, Jessa ma, Kochapa ma, and lastly Teuchu ma on the Dinoi.

This, however, is over a long line of hilly country and ends far to the west in the valley of Hukong, and from whence any road east must cross the whole line of northern drainage, whereas the endeavour should be to keep in the *level plains of Assam* as long as possible, having in view the facilities on the southern side, and also to penetrate the mountain barrier where not only lowest but narrowest.

Once the plains of Hukong are reached, say near Numphin or old Bisa,

on the Turong, the line would keep north of the Dinni River, crossing a country covered by open undulating grass plains, whence *vid* the low Kako hills it could join the trade route to Mungla east of the Irawadi.

The Shuamai, or Phungmai Kha, on which this town is situated, is generally believed now to be the main stream of the Irawadi and flows from the N. E. through a large plain or valley called the Sittang country. There can be little doubt but that Dr. J. Anderson* is correct in supposing that this river has its rise in Eastern Tibet.

It is hardly necessary to remark that a route over Patkai to Upper Burma *alone*, is not pressingly required; what is really in demand (and will continue in demand until solved) is a good route joining India with China.

The advocates of a route to Western China may be divided into three parties. 1st, those who would start eastwards almost at once from near Rangun, and may be called the "Marine" party: 2nd, The far more legitimate one that advocates a line through Burma to the upper provinces, ere starting east, so as to gain not only the China trade but benefit Burma itself by a good line of internal communication; these would be the "Burmese" party: 3rdly, There is a large party both in India and England, if not also in China, who are in favour of a more direct line between India and China if it were possible, even if it had to pass *via* the Hukong valley, and across the northern extremity of Upper Burma, towards Talifu and the Yang-tse-kiang.

These three parties are, so far, distinct, if not actually in opposition to one another, but the question is becoming gradually much simplified. The Marine (or Manchester party) now that India can, and will, beat Manchester in the cotton trade, is certain to die a natural death; a trade route with China *vid* the *mouth* of the Irawadi is not in demand, so that only the Burmese and Indo-Chinese parties remain. These should really not be found in opposition at all, if the Patkai route is possible; on the contrary, their interests are almost identical; a junction on the upper Irawadi would benefit both.

To imagine that the trade to England from western China, would go by the valley of Assam, while the Irawadi was open, would be absurd. It would be equally so to expect the Indian trade to go *vid* the Irawadi; each would take what legitimately belonged to it; indeed, without combination between these two parties it does not seem likely that a route to Western China will ever be possible. There is actually no reasonable ground why either should oppose that combination, while there is everything to gain by union.

The immediate future of Burma it is not difficult to forecast, and with

* Journ. Royal Geog. Soc. Vol XL, 1870, p. 286.

such an object in view, as a route joining the two largest empires of the East, it behoves us to look ahead.

The difficulties in connexion with a good trade route from India to China *viâ* Patkai and upper Burma are not *physical ones*, as has hitherto been supposed; the only real obstacles are political ones, which would vanish, the moment Chinese and Burmese jealousy was overcome.

The obstacles to trade, in fact, are all confined to one tribe or race, the Singphús or Kakhyens, who inhabit the hills between Assam, Burma, and China, and by a state of tolerated anarchy, effectually prevent peaceful intercourse.

Until some central authority is recognized, and joint action taken, it is not easy to make head against these turbulent clans; an alliance for their suppression, would at once solve the Indo-Chinese route question, *viâ* Assam.*

APPENDIX.

The following few extracts from the diary of Mr. A. J. Peal serve to corroborate the remarks made by Pemberton before quoted, as to the line of route.

"December 6th, 1869. We had great difficulty to get the men to start, and were not off till noon, crossing soon after a couple of low hills, due south of the village (of Namphúk), we struck the Namrúp again and eventually camped 3 or 4 miles up its bed.

"7th. Continued up the bed of Namrúp, and subsequently the Nam-bong, camping at mouth of the Nanki.

"8th. Marched up the bed of the Nanki after boiling water at $211\frac{1}{2}^{\circ}$ thermometer at 56° , and commenced the ascent of "Patkai" at 11:30 A. M. reaching the summit at 2 P. M., after a hard climb. Boiled water on the top at a temperature of 208° , thermometer 66° . We camped at the first water on the southern slope at about 400 feet down, and had a fine view of the Nongyang lake and also the Brahmaputra.

"9th. We boiled water ere starting at $208\frac{1}{2}^{\circ}$, thermometer at 55° , descended pretty easily and rested at the ford of the Nongyang river at 11 o'clock, route E. S. E. Subsequently crossed a spur of Digam Búm nearly as high as Patkai, camping at a small stream half way down the other side, course S. E. and tortuous, say 14 miles.

"10th. Started about 9 A. M. and by 10:30 reached the Digampáni, crossing and re-crossing several times, and after ascending a low ridge came suddenly on the Loglai (or Loklæ Kha) of which we had a fine view.

* The greater portion of this note was written in 1872.

The bed some 80 or 100 feet below was say 100 yards wide, composed mainly of slaty rock, and with long rapids.

"11th. Marched down the bed of the Loglai, which being composed of boulders was very fatiguing, we passed some fine rapids, and camped at the mouth of the "Kaisu," having only done about 8 miles. We found no dew south of Patkai at night.

"12th. We ascended the bed of the Kaisu and crossing "Kasukú," (or hill) struck the Namlip, after going down which for some 6 miles, camped at the mouth of the Yungsum, a small stream.

"13th. From the Yungsum we crossed a low ridge to the Yungmoi and followed it out to the Namyung river, which we reached at 4 P. M., finding it about 80 yards wide and flowing over shingle. Men at once started on to the Númyúng village for food. J. brought back rice, fish, &c.

"14th. Reached Númyúng village in half an hour after breakfast, finding a nice open place and rice lands, and were very hospitably received."

The party were here met by messengers from the chief of the Dinei villages prohibiting an advance. While waiting result of a friendly message in return, many traders passed, with daus, amber, &c., for Assam; others again came in from Assam, and from the Nága hills west; a great deal of information was gained from five men who had come from near the Irawadi, due east, they said a great many Chinese passed through their villages to and fro, trading with Hukong, so much so that both they, their wives and even children, could understand Chinese.

The extracts relating to the return journey also completely corroborate what was already known as to the difficulties of the Tíráp or Griffiths' route, by which the party returned.

"26th December. Started at 10 A. M. back, after some trouble with the carriers who refused to take the loads by that route, through the Nága hills. He reached the mouth of the Chilly (Tsili) about 4 P. M. after a march of 15 miles.

"27th. This day we arrived at the first Mosang Nága villages; distance 10 or 12 miles.

"28th. Passed through several Mosang Nága villages and camped in one with 60 houses at 1,500 feet elevation.

"29th. After starting, we ascended a very high hill or range (Gedak Búm, say over 5,000 feet) and then down some 500 feet to a Nága village on a spur, surrounded by other villages not far off. They have a fine breed of cattle, and a peculiar hairy little dog like a terrier.

"30th. To-day crossed another high ridge, and camped some 300 feet

down it on the other side, at the first water, it was Patkai. Found it very hard work, as the southern faces of the ranges are either open cultivation, or deserted *jhums*, destitute of shade, the path in many places almost perpendicular.

"31st. Again over a ridge of Patkai; water boiled at 208°, and we started down to the valley of the Namtsik, where we camped.

"January 1st, 1870. Crossed another high range, over 3,000 feet, crossed a stream, ascending again to Yugli at 3,000 feet or more, from whence we had a fine view of the Tirap valley, and Rangatu rising beyond it to over 3,500 feet, the peak about 4,500.

"2nd. We came down from Yugli to the Tirap river, rising again to 3,500 feet over Rangatu, thence along a ridge passed Rangnam, and down to the river Ti keng, thence up to Kongtam 2,000 feet and *vid* Wado to Tirap Múk on the Dihing river."

*Elevation of some of the "Passes" north of India, Nipal and Assam, also of some in Tibet.**

				feet above the sea.
Chang chenmo, (Lon. 79°, Lat. 34° 30')	...	...	...	19,000
Cho morang la, (Tibet)	...	...	...	18,760
Cho la, (Sikim Chumbi)	...	...	...	15,000
Donkia, (Sikim Tibet)	...	...	...	18,468
Ga la, (Nipal)	...	...	...	16,700
Gua tina la, (Sikim Chumbi)	...	...	...	14,000
Jelep la, (Sikim Chumbi)	...	...	...	13,000
Kongra lama, (Sikim Tibet)	...	...	...	15,740
Kambala, " "	...	...	...	...
Khalamba la, (Tibet)	...	...	...	17,200
Lágúlúng lá, "	...	...	...	16,000
Mariamla, "	...	...	...	15,500
Nilam, (Nipal Tibet)	...	...	...	16,628
Nola, " "	...	...	...	16,720
Photulá, (To Tibet)	...	...	...	15,080
Tiptala, (Sikim)	...	...	...	...
Taklakhar, (Nipal Tibet)	...	...	...	...
Taukra la, (Sikim)	...	...	...	16,088
Walung chung, (East Nipal and Tibet)	...	...	...	10,885
Yakla, (Sikim Chumbi)	...	...	...	14,000
Tulalah, (Bhutan)	...	...	...	10,000

* These are not selected passes, on account of their altitudes, but are those best known at the moment of writing.

The average height is 25,468 feet.

DR. GRIFFITHS' ROUTE.

Extracts from Dr. Griffiths' notes regarding the route over Patkai, starting from the Dihing River.

Date.		Miles.	Direct.	Elevation.	
Feby.	19th,	12	S.W.	1,029	crossed Tirap several times and along difficult places.
"	21st,	10			winding difficult path : camped on Tirap.
"	22nd,	12		1,029	route difficult.
"	23rd,	12	S.S.E.	1,413	out of Tirap, crossed high ridge 2,500 feet down to Namtsik.
"	24th,	10	S.S.E.		marched up the bed of Namtsik.
"	25th,	4	S.S.E.	3,026	ascended ridge to 3,500 feet.
March	3rd,	15	S.S.E.	5,000	started up Patkai 1,500 feet above camp, down to boundary (i. e. Nongyang).
"	4th,	10	E.S.E.		fatiguing march, (perhaps down Nongyang).
"	5th,	4	E.S.E.	2,138	met Dr. Bayfield.
"	13th,	7	E.S.E.		down Nam ma roan, (i. e. Namyung) passed village.
"	14th,	7	E. by S.		Do. Do.
"	15th,	13	E. by S.	5,516	ascended some hours to 5,576 feet, to Natkaw and Kusi.
"	16th,	18	S.	3270	camped at 5,516 feet elevation.
"	17th,	10	E.S.E.		descended considerably, camped on Gedak bum (path over 5,000 feet).
"	18th,	18	E.		descended Gedak to Namtsik.
"	22nd	18	N.N.E.		Route circuitous, heavy jungles to Namtsik and Turong Rivers.
"	28rd	10	S.S.E.	1,840	Shelling Khat and Kulyung.
"	24th	17	S.W.	1,064	to Lamun and Tsilone River B. Dinei River 300 yards across.
"					to Mainkwon.

The above has been collated, and names where wrong spelt, altered.

PEMBERTON'S REPORT OF ROUTE FROM BISA.

Probably from Lieut. Burnett's report, March 1828.

Stages	Miles	
1st,	16	Bisa, 10 miles to the gorge and thence to Namrup River.
2nd,	12	Namrup, over 2 hills, camped at Nunnun.
3rd,	11 ?	Nunnun, to Namrup again, and on to the Khasia, or Khasi.
4th,		Khasi to summit Patkai, 4 miles, down to Loglai.
5th to 11th		Loglai to old Bisa, 6 days.
12th to 20th		Bisa to Magaung 8 marches.

Mogong or M'gaung is the Mong maorong of the Shans, and on the Mogong river, that falls into the Irawadi.

The first eleven stages are nearly identical with Dr. Griffiths' route.

Route from Tirap to Hukong (Mainkwan) by Mr. H. L. Jenkins.

STAGES	ASSAM TO HUKONG.	and HUKONG TO BAMO.
1.	Terap muk to Kongtam.	A. Hukong to Jambu hill.
2.	Kongtam „ Youngbhi.	B. To Lebong village on the Nun-kung.
3.	Yungbhi „ Yugli.	C. Down it to Namsang muk.
4.	Yugli over Patkai.	D. Do.
5.	Patkoi to Mosang Naga village.	E. Land march to Santok hill.
6.	Naga village to Johanghai.	F. To Nunhang River.
7.	Johanghai to Wada pani.	G. Down Do.
8.	Wada pani to Gedak Bum.	H. Do. to Benauko Singphu vil-lage.
9.	Gedak Bum to Disang River.	I. Melankha, on U'rip.
10.	Thence to Sumbogan, Singphu village.	J. To small stream ; long march.
11.	Thence to Hukong short march.	K. To Bamo, a long march.
Eleven stages to Hukong.		Eleven stages to Bamo.

EXTRACT FROM ASSAM BOUMJI RELATING TO PATKAI.

(*History of the Kings of Assam*, p. 13.)

এনেতে আমাৰ কালৰ ভাডান্ বিজ বৰ গোঁহাই বাহি সে পাটকাইতে দুয়ো নলে মিলামিলি হল। পাছে দুয়ো কালৰ ৰাজ আজাৰে দুয়ো নলে পাটকাইৰ ওপৰৱৰনজ এভাজ পানিতে হাত জোবৰাই, এহং কুকুৰাকো কাটী লপত কিল্ৰ জাক্ৰি ডাকমাও ১০২০ সঁকত পাটকাই পৰ্বতকে লিমা কৰি দুয়ো বৰ গোঁহাঁইৰ দুটা মুৰ্তি সিলতে কটালে। নজ এভাজৰ অৰ্থ এই, নজ বিল, এভাজ আছে। আৰু বুলিলে বোলে, এই পৰ্বতকে আমি লিমা কৰিলো; এতেকে দুইয়ো মুৰ্তি এই চিন থাকিব, আৰু এই লিমা এৰি কোনেও বাহি কোনো কাললৈ আক্ৰমণ কৰিব নেপাই। এই ৰূপে মিলামিলি কৰি লিমা পাতি উভয়েই আপন ঠায়ে ২ গল। পাটকাই পৰ্বতক চুকাফ ৰজা দেও-অসম দেশলৈ অহা কালত উইকাউৰজ বুলিছিলে। তাৰ অৰ্থ এই, উই পৰ্বত কাউ ৯ টা, ৰজগোট খোৱা। পাছে এই লিমা কৰাৰ পৰা পাটকাই চেঙ্গকান বুলিলে; পাচলৈ কেবল পাটকাই নামহে জলিল। ঐ পাটকাই চেঙ্গকানৰ অৰ্থ এই, পাট কাটি, কাটিকুকুৰা, চেঙ্গলপত, কানলপালে, সেই ঠাইতে।

VIII.—*On a new Standard of Light.*—By LOUIS SCHWENDLER.

(With Plate VIII.)

No exact measurement of any quantity, even with the most accurate and sensitive Test-methods available, can reasonably be expected unless the standard by which the unknown quantity is to be gauged is perfectly *constant* in itself; or, if nature does not permit of such a desirable state of things, the causes to which the variation of the standard are due, should be known, and in addition also their quantitative effect on the standard, in order to be able to introduce a correction whenever accuracy of measurement should permit and circumstances necessitate it.

This requirement for a standard necessarily entails on the one hand a knowledge of the relations which exist between the standard and the causes of its variation, and on the other hand the possibility of an accurate and independent measurement of these causes.

Further, having no constant standard, it is impossible to produce two quantities of the same kind bearing a fixed and known ratio to each other. Consequently, no idea can be formed of the accuracy of the test-method adopted, and if such is impossible we are also unable to improve the test-method in itself, *i. e.*, with respect both to accuracy and sensitiveness.

The inconstancy of a standard acts, therefore, perniciously in two directions: it prevents us from being able to execute accurate measurements even with the most accurate and sensitive test-methods, supposing such are available; and further leaves us in that deplorable condition of not being able to improve the test-method, although we may be convinced that the method of testing requires such improvement.

It may be safely asserted that in any of the branches of the physical sciences, where constant standards do not exist, the progress in accurate knowledge of nature must be slow, if not impossible.

This train of thought will, I think, invariably beset the physicist who endeavours to make Photometric measurements.

Recent experiments on the value of the electric light as compared with the ordinary means of illumination,* called my attention forcibly to this point.

* These experiments I had to institute on behalf of the Board of Directors of the East Indian Railway Company, under orders of the Secretary of State for India, to enquire into the feasibility and practicability of lighting up Indian Railway Stations by the Electric Light.

Old Standards for Light Measurements.—Up to the present in England the *Standard Candle** has been adopted as the standard of light, the unit of light being defined as that light which the said candle emits when burning steadily at a certain definite rate. In France the *Carcel Burner* (Bec Carcel) has been introduced as the standard of light. The unit of light in this case being defined as that light which emanates from a good moderator lamp burning pure colza oil, at a given definite rate. The ratio of these two arbitrary units, is given by several authorities very differently, the mean value being about :—

10 Standard Candles = 1 Carcel Burner.

These two standards of light, although answering perhaps certain practical requirements, are by their nature ill-adapted to form the units of light intensities. A good and trustworthy standard should possess absolute constancy, or if not, should afford the possibility of application of a correction for the variation and, moreover, should be capable of accurate reproduction. These qualifications are certainly not possessed by the standards at present in use.

A candle of whatever compound and size will partake of something of the nature of a complex body, an accurate reproduction of which must always be a matter of great difficulty. Exactly the same holds good for the Carcel Burner.

Further the amount of light these standards produce, depends to a very considerable extent on external influences, which do not allow of easy control or measurement, and which therefore cause variations in the standard light for which it becomes impossible to introduce a correction. For instance, the rate and regularity with which a candle burns and the amount of light it gives, depend, in addition to the material of which the candle consists, on the ready and regular access of oxygen. In a closed up place, like the box of a photometer, if the draught is not well regulated or the supply of fresh air not quite constant, it can be easily observed that the very same candle may emit light at different times varying as much as 50 per cent. Another difficulty is introduced by the variation of the length of the wick, and of the candle itself, by which the standard light necessarily alters its position in the photometer and consequently its quantitative

* The Metropolitan Gas Act 1860 (23 and 24 Vict. Cap. 125, Sec. XXV) defines the standard candle as :—

"Sperm candles of 6 to the pound each burning 120 grains an hour." I have tried the standard candles as made by two different manufacturers, Messrs. Field and Co. and Mr. Sugg. These candles are sold as six to the pound, and consume according to my own experiments about 8.26 Gm per hour when placed in a large room and direct draughts excluded.

effect on a given point. These difficulties might be overcome to a certain extent by mechanical means ; as, for instance, by cutting the wick automatically within equal and short intervals of time, and by placing the candle in a closely fitting metal-tube, against the top rim of which a spring presses the burning candle, in fact a similar construction to that used for carriage candles. But to say the least, all such arrangements are cumbersome. Without going into further details with reference to the Carcel Burner, it may be said that the disadvantages of this standard are at least equally great. In fact it appeared to me that the production of a standard light by combustion is not the right method ; the flame resembles too much organic life with its complex and incessantly varying nature. Gauging mechanical force by the power a particular horse of a certain breed is able to exert, can scarcely be called a less scientific standard, than the combustion standard for measuring light. Under these circumstances, I thought it best to leave the old track, and produce the standard of light, *by the heating effect a constant current has, in passing through a conductor of given mass and dimensions.**

New Standard of Light.—Several Platinum Photometric Standards were made and tried. If the current passing through the platinum was kept constant, the light produced was also constant, and for the same current and the same platinum standard, the light was always of the same intensity, under whatever other circumstances the experiments were conducted.

Platinum evidently is the best metal which can be chosen, for it does not change in contact with oxygen ; it can be procured very pure and its melting point is high enough to allow an intense light.

It is probable that at a high temperature platinum becomes volatilized, but this process can only be exceedingly slow, and therefore the light produced by a standard, cannot alter perceptibly in time. To make the light constant from the moment the current passes, *i. e.*, to establish dynamic

* The idea of using the light produced by a conductor through which a strong current passes, as the unit of light, appeared to me so natural and simple, that I could scarcely understand why it had not been proposed and acted upon before.

I could however find nothing on the subject anywhere, until lately my attention was called to a small pamphlet written by Zollner in 1859 in which the same idea occurs :

In the preface to his Inaugural Dissertation, Zollner says :—

“andererseits aber auch zu zeigen, dass ein galvanisch glühender Platindraht von den bis jetzt bekannten Lichtquellen zur Aufstellung einer photometrischen Einheit, trotz mancher practischer Schwierigkeiten, vielleicht dennoch das geeignetste Mittel sei.”

I have since learnt that Dr. Draper, as early as 1844, proposed a “unit lamp” consisting of a platinum strip heated by an electric current.

equilibrium between the heat produced and the heat lost per unit of time, it is necessary to make the arrangement in such a manner, that the electric resistance offered by the standard is only in the piece of platinum, intended to be made hot by the current, and not in the other parts of the circuit.

For this reason I find it best to cut the piece of platinum out of a platinum sheet.

Figure 1, Plate VIII gives the form in actual size. The two ears, left white in the drawing, may then conveniently form the electrodes between the leading wires and the piece of U-shaped platinum which has to produce the light. As the U-shaped portion is left in its natural connection with the ears, the contact takes place over a large surface, and therefore the contact resistance must be small. This special form, if the dimensions are defined as well as the weight of the platinum sheet, out of which it is cut, can be easily reproduced anywhere. Further it is required to exclude the draught from the heated platinum. This is best done by putting on a cover of thin white glass. One half of it is left white, the other half is blackened on the inside. This precaution is required in order to insure that light emanating from one side only of the platinum is used in the photometer.

Otherwise light from the back part of the heated platinum, would be reflected into the photometer. This part is unknown and could therefore not be taken into account when measuring the light emanating from one side of another light. In fact to be able to form right conclusions from Photometric measurements, it is necessary to arrange the experiment in such a manner that either the two lights under comparison throw the same fraction of the total light into the Photometer, or if this is impossible, to ascertain this proportion accurately.

The Platinum Standard light (PSL), described before, we will call in future A. Sending a current of 6.15 webers through it (15° deflection on my large Tangent Galvanometer, for which the constant = 2.296 C. G. S.), the PSL (A) produces a light equal to 0.69 Sugg's candle, or,

$$1 \text{ Sugg's candle} = 1.44 \text{ PSL (A) with} \\ 6.15 \text{ webers.}$$

Hence, if this particular light were adopted as the unit, we might define it as follows:—

6.15 webers passing through a piece of Platinum 2 mm. broad, 86.28 mm. long and 0.017 mm. thick, weighing 0.0264 Gm., having a calculated resistance = 0.109 S. U., and a measured resistance = 0.148 S. U. at 66° F. gives the unit for light intensity.*

* In order to show that a platinum light standard can easily be reproduced, I will give here some actual measurements:—

The Platinum sheet out of which the P. S. L. (A) was cut weighed 0.0264 Gm. per square centimetre. From this the weight of the part which becomes hot calculated,

Photometric Measurements. Having now a constant light it became possible to measure the variations of light which the combustion standards invariably show.

For instance one of Sugg's Candles was compared with the P. S. L. (A) with the result shown in the following table :—

Distance in Millimetres.		REMARKS.
P S L (A) with 6.15 webbers	Sugg's candle	
100 mm	117 mm	<p>The P S L (A) was kept at the same position = 100 mm</p> <p>Sugg's candle was moved in order to get the light equal.</p> <p>The variations observed were actually in the candle and not in the Platinum standard, as the eye could easily discern.</p>
	120	
	112	
	110	
	120	
	120	
	120	
	120	
	128	
	128	
	117	
	120	
	123	
	127	
These readings were taken in about five minutes		

This gives as an average —

1 Sugg's Candle = 1.44 P S L. (A) with 6.15 webbers.

$\frac{\text{Max}}{\text{Min}} = \frac{1.64}{1.21}$, or total variation of the candle about 30 per cent. from

the average, in the very short interval of time of about five minutes. This needs no further comment. Some additional experiments were made in order to ascertain the variation of the light of a standard candle.

gives 0.0264 Gm. The resistance of the standard, measured at 66° F., gave 0.143 S. U., including contact resistances.

Now another piece of Platinum sheet 26 × 28 mm was found to weigh 0.265 Gm. The piece cut off which actually becomes hot = 0.026 Gm., which agrees within 0.0004 Gm., with the weight found by calculation for the P. S. L. (A) actually used.

Taking the specific resistance of Mercury = 96190
of Platinum } = 9158 } at 0° C.
annealed }

the calculated resistance of the Platinum which becomes hot = 0.109 } S. U. at
Measured resistance, including contact resistance = 0.143 } 66° F.
or contact resistance probably = 0.034 S. U.

It is therefore much more accurate to define the P. S. L. by weight, than by resistance.

The P. S. L. (B)* with a current = 5.9 webers was used as unit.

1st Candle, 7 readings in 10 minutes

mean = 1.08 P. S. L. (B)

$$\frac{\text{max} :}{\text{min} :} = \frac{1.19}{1.00} \text{ or total variation} = 17.6 \text{ per cent.}$$

The maximum was obtained directly after having opened the Photometer when fresh air entered.

2nd Candle, 10 readings in 14 minutes

mean = 1.07 P. S. L. (B)

$$\frac{\text{max} :}{\text{min} :} = \frac{1.32}{0.69} \text{ or total variation} = 59 \text{ per cent.}$$

The minimum was obtained directly after freshly lighting the candle.

3rd Candle, 12 readings in 24 minutes

mean = 1.07 P. S. L. (B)

$$\frac{\text{max} :}{\text{min} :} = \frac{1.90}{0.81} \text{ or total variation} = 46 \text{ per cent.}$$

The lowest reading was obtained shortly after lighting the candle.

4th Candle, 14 readings in 22 minutes

mean = 0.94 P. S. L. (B)

$$\frac{\text{max} :}{\text{min} :} = \frac{1.26}{0.58} \text{ or total variation} = 72 \text{ per cent.}$$

The lowest reading cannot be accounted for.

Two new Platinum Light Standards of the same form and size as the P. L. S. (A) described before, were placed in circuit of 8 Grove's cells connected up successively and with a Mercury Rheostat in circuit, to keep the needle of the Tangent Galvanometer at a constant deflection.

These two new P. L. S., called II and III, were placed in the Photometer to compare their lights and by it test the accuracy of the Photometer readings, and other influences to be named further on. (see fig. 2, Plate VIII.)

$$d + d' = D = 250 \text{ mm (constant).}$$

Light s produced by P. L. S. (III), Light s' produced by P. L. S. (II). The balance between the two lights being obtained by moving the prisms within that fixed distance. A piece of red glass was used for taking the readings.

* This Platinum standard (B) was the first made, and has a different form from the other (A) described: Dimensions and weight cannot be accurately given now.

In the following table the results are given :—

No of Experiment.	P. L. S.		Deflection on Tangent Galvanometer	$\frac{r^2}{s}$	Remarks and particulars.
	II producing $\frac{1}{s}$ mm from Prism	III producing $\frac{1}{s}$ mm from Prism			
1	100	150	18.8		Both lights having glass covers, but glasses were quite clear.
	100	150	18.8		
	100	150	18.8		
	100	150	18.8		
	100	150	18.8		
	99	151			
	100	150			
1	99.86	150.14	18.8	0.41	
2	103	147	18.8		A clear glass cover on No. III, no glass cover on No. II.
	102	148	18.8		
	102	148			
	103	147			
	102	148			
2	102.4	147.6	18.8	0.48	
3	98	152	18.8		A clear glass cover on No. II, no glass cover on No. III.
	97	153	18.8		
	98	152	18.8		
	98	152			
	98	152			
	99	151			
	98	152			
3	98	152	18.8	0.42	
4	98	152	18.8		A glass cover on No. III, the back of it covered inside with black paper, a clear glass cover on No. II.
	98	152	18.8		
	99	151	18.8		
	100	150	18.8		
	100	150			
	98	152			
4	98.88	151.17	18.8	0.43	
5	101	149	18.8		Both lights covered up with glass covers, each glass cover having inside a black paper.
	101	149	18.8		
	102	148	18.8		
	101	149			
	101	149			
5	101.2	148.8	18.8	0.46	

No. of Experiment.	P. L. S.		Deflection on Tangent Galvanometer.	$\frac{r}{d}$	Remarks and particulars.
	II producing d^2 mm from Prism.	III producing d^2 mm from Prism.			
6	103	147	21.0		Current increased by decreasing the resistance of the Mercury Rheostat, but kept constant at 21° Clear glass again on both like experiment No. 1.
	101	149	21.0		
	101	149	21.0		
	101	149	21.0		
	101	149	21.0		
	101	149	21.0		
6	101.3	148.7	21.0	0.46	
7	104	146	21		Clear glass cover on No. III. No glass cover on No. II.
	103	147	21		
	102	148	21		
	102	148	21		
	102	148	21		
	102	148	21		
7	102.6	147.4	21	0.48	
8	101	149	21		Clear glass cover on No. II. No glass cover on No. III.
	100	150	21		
	100	150	21		
	99	151	21		
	100	150			
	100	150			
	100	150			
8	100	150	21	0.44	
9	101	149	21		Both the clear glass covers on.
	101	149	21		
	101	149	21		
9	101	149	21	0.46	

The Deflection 18.8° represents a current = 7.82 webers.

The Deflection 21.0° represents a current = 8.81 webers.

From these results the following conclusions can be drawn :—

The thin glass covers, as was to be expected, absorb a measurable quantity of light. Compare the results of experiments Nos. 1, 2 and 3, and of 6, 7, 8 and 9.

Covering the glass covers inside with black paper to avoid back-

reflection, appears to weaken the light, as was to be expected. Compare the results of experiments Nos. 1, 4 and 5.

The ratio $\frac{z^1}{z}$ of the two lights is independent of the strength of the current, which it ought to be.

These results, although showing nothing extraordinary, *i. e.*, what could not have been foretold without making the experiments, are nevertheless valuable, since they prove that in the first instance thin glass covers take away very little light, and that back-reflection is also very little; but small as these influences are, they have been unerringly measured by the Photometer, showing this instrument to be very accurate and the eye quite trustworthy. That the light z produced by P. L. S. III was so much more intense than z^1 produced by P. L. S. II, is due to the fact that the Platinum sheet out of which No. II. was cut was much thicker than the other.

Detailed description of the Standard and the method of using it.

Fig. 3, Plate VIII. gives the construction of the Platinum standard in half its natural size. I need not give further explanation on this point as everything will be readily understood from the drawing.

Fig. 4 shows the diagram of the connections.

P. L. S. is the standard—

G a current indicator, or better, current measurer. The deflecting ring must consist of a few convolutions of thick copper wire—of no perceptible resistance. The small magnet needle is best to be pivoted, carrying a long aluminium index.

E is the battery, consisting of a few elements of high E. M. F. and low internal resistance connected up successively. Grove's, Bunsen's or large Daniell's cells will answer well for the purpose.

(1) is a stopper by which the circuit can be conveniently opened or closed.

M is a mercury rheostat of about one unit resistance. A groove of about 1 mm. section and 1 metre total length is cut into hard wood (not ebonite, as mercury does not run well in ebonite). The hard wooden board is supported by three levelling screws.

Further the mercury is in perfect metallic contact with two iron terminals *f f*. These terminals are not to be fixed to the board. They are simply placed into the mercury, which fills small reservoirs at each end of the mercury thread.

The resistance of the mercury rheostat can be easily altered by moving the bridge *b* along the two parallel mercury grooves. If the bridge is taken out, the total resistance of the rheostat is in circuit.

If the bridge b is close to the two terminals $f f$, the resistance of the rheostat is nil.

This range of resistance with about 6 to 10 volts will prove sufficient to make the current strong enough and to keep it constant for many hours, especially if the precaution is taken to open the circuit when no light is required. The bridge b consists of a strip of copper at least 2 cm. broad and 1 mm. thick. The knife edges which dip into the mercury are amalgamated.

The current measurer G has been gauged by comparison with a standard tangent galvanometer; so that the currents indicated by certain deflections of the needle are correctly known in absolute measure.

Whenever a Photometric measurement is made the current is adjusted to its defined strength, i. e., the given known deflection is procured by moving the copper bridge b .

If the instrument G is well constructed, this adjustment of current strength can be executed as accurately as weight measurement by a chemical balance.

Correction for the Standard.

Although with the above arrangement it will be always possible to keep the current constant and up to its defined amount, it might nevertheless happen under particular circumstances that the current producing the light has been rendered different from the current for which the standard has been defined.

In this case the following correction can be applied.—

$$i = \frac{1}{(1 + \alpha) \left(\frac{c}{\gamma}\right)^n - \alpha}$$

where c is the current for which the intensity of the light has been defined as unity.

γ the actually observed current, and α the co-efficient for platinum which gives the percentage variation of resistance for high temp, 1500°-2000° F. for 1° Celsius.

This correction has been developed under the supposition that the light produced in the given piece of platinum is proportional to the work done by the current through the resistance of the platinum, and that, further, temperature and light are proportional. These suppositions are almost correct for small variations of the current.

In conclusion it may be stated that it was ascertained that the Platinum Light Standard (B) produced the unit intensity of light, (the unit of light equal to the light emitted by the Standard Candle) at a total expenditure of energy equal to 427 Ω ergs per second. Of these, 300 Ω ergs were actually transformed into light by heating the platinum up to a high temperature; while the remaining 127 Ω ergs were lost for illuminating purposes, being used for raising the temperature of the circuit exclusive of the Platinum Standard.

The Platinum Light Standard (A) being made of much thicker platinum sheet, showed a much less favourable result. The unit of light by (A) was produced at a total expenditure of energy equal to 1226 Ω ergs per second, of which 725 Ω ergs were actually transformed into light, the remaining 501 Ω ergs were wasted in heating the circuit to low temperature (no light). Considering that the unit of light can be produced in an electric arc at a total expenditure of energy of 10 Ω ergs per second only (see my *Précis of Report on Electric Light Experiments*, London, 1st Nov. 1878, p. 11), when produced by Siemens's intermediate Dynamo-Electric Machine, it follows that from an engineering point of view, light by *incandescence* can scarcely be expected to compete with light by *disintegration* (electric arc).

In fact, it appears that light by *incandescence* is scarcely any cheaper than light by *combustion*. The reason for this is that the temperature of an incandescent platinum wire is not very much higher than the temperature of a flame, and that for unit volume the mass which has to be kept up heated in a piece of platinum is much larger than the mass in a flame. Unless we should be fortunate enough to discover a conductor of electricity with a much higher melting point than platinum, and that the specific weight and specific heat of that conductor is also much lower than for platinum—and that at the same time the new conductor does not combine at high temperatures with oxygen, we can scarcely expect that the principle of *incandescence* will be made use of for practical illumination.

Further it was ascertained that the resistances of the platinum light standards (not including constant resistance) were as follows:—

$$\text{P. L. S. (B)} = 0.136 \text{ Ohm at } 22.2^{\circ} \text{ C.}$$

$$= 0.876 \quad \text{,, at the temperature of the standard,}$$

$$\text{where the light was measured, or increase } \frac{0.876}{0.136} = 6.44.$$

$$\text{P. L. S. (A)} = 0.102 \text{ Ohm at } 18.9^{\circ} \text{ C.}$$

$$= 0.964 \quad \text{,, at the temperature of the standard,}$$


$$\text{where the light was produced, or increase } \frac{0.964}{0.102} = 9.45.$$

I regret that I have not been able to calculate from the above results the temperature of the heated platinum, since I could not procure in time a copy of Dr. William Siemen's Bakerian Lecture (1871), which at present, to my knowledge, is the only source where the increase of resistance of platinum at high temperatures can be found.

To sum up :—

The advantages of the new standard of light are :—The light is perfectly constant if the current be kept constant ; it allows a correction to be made for the variation of the current if this variation is known ; it can be reproduced accurately everywhere if ordinary precautions be taken to secure pure platinum ;* its magnitude can be altered to any extent to suit certain practical purposes by simply varying the elements of weight, shape, and size of the platinum, or the strength of the current passing through it, it does not alter of itself either in intensity, size, or position, and therefore by it most accurate photometric measurements can be executed ; the standard can be easily made to fit into any adopted system of absolute units. Hence the new standard fulfils *all* the recognised conditions of a perfect and rational standard, and therefore it would be advisable to adopt it in future, as the practical standard for light-measurement. There would be no practical difficulties met with in the introduction of the new standard for technical purposes.

* The conductivity of any metal is much lowered by slight impurities, and platinum does not form an exception. Hence great care must be exercised in the selection of platinum for the light standard. Dr. William Siemens in his Bakerian lecture says : "The abnormal resistance of some platinum is due chiefly to the admixture of iridium or other metals of the same group, and it appears that platinum prepared by the old welding process is purer and therefore better suited for electrical purposes than the metal consolidated by fusion in a Deville furnace."



IX.—*A second note on Mammalia collected by Major Biddulph in Gilgit.*—By W. T. BLANFORD, F. R. S., &c.

(Received and read May 7th, 1879.)

In the Journal of the Society for 1877, (Vol. XLVI, Pt. 2, p. 323,) I gave a brief note of some mammalian skins sent by Major Biddulph from Gilgit, comprising a fox, an otter, a mouse, a hare and a *Lagomys*. Another small collection has since been forwarded to the Indian Museum by the same officer. This is even more interesting than the last, for two of the species belong to a genus, *Cricetus*, not previously found in the valley of the Indus, although widely distributed in Central Asia. At the same time a rat is sent that is undistinguishable from a common Indian species. The other skins belong to a mouse and to two species of fox. On each of these I will add a few notes.

1 and 2. *Fulpes*, 2 sp. Two fox skins sent by Captain Biddulph are very difficult to determine. The larger is an animal apparently about the size of *Fulpes montana*, but darker in colour and much less rufous. The dark colour, so far as is it due to the black tips of the longer hairs, may perhaps vary with age, but it is in great measure caused by the under-fur, which differs from that of *F. montana* in being more dusky, and especially in being brown at the extremity instead of bright rufous. The ears are sooty outside instead of black, and the throat is not so dark a grey as in Simla specimens of *F. montana*, but these differences are not of much importance.

There is a well marked distinctive character in the skull of the two types. The brain-pan in the Gilgit fox is broader and higher, and the occipital portion in consequence differently shaped. The lower jaws too are somewhat different.

The following is a description of the skin, which was evidently procured in winter.

General colour dusky fulvous, the colour being much darker in consequence of the under-fur shewing through; there is a slight rufous tinge on the back caused by the extremities of the long hairs being tinged with red; lower parts dusky grey, outside of limbs and of ears sooty black, margins of ear covered with dense short hairs of a creamy white or pale buff colour; face pale rufous, darker in front of the eye, with a brown patch before each eye. Whiskers black. Tail tip wanting, the basal portion pale fulvous, with black tips to the long hairs. Hairs of back of neck and of flanks also black tipped. The under-fur on the back very long and woolly, of a brownish grey colour, paler at the base. Ends of the longer hairs very pale fulvous.

Feet thickly covered with brown hair beneath, so that the toe pads are almost concealed. Hind foot and tarsus nearly 6 inches long.

The following are comparative measurements in inches of the skull with that of a ♀ *V. montana* from Simla.

	Gilgit fox.	<i>V. montana.</i>
Length from base of foramen magnum to end of premaxillaries,	4.85	4.92
Breadth across zygomatic arches,	2.92	2.83
Ditto of brain-pan where widest,	1.97	1.76
Height of ditto from lowest part of auditory bullæ,	2.05	1.8
Breadth of cranium behind postorbital processes,	0.9	0.78
Breadth across postorbital processes,	1.25	1.23
Length of suture between nasals,	1.73	1.75
Ditto of bony palate from opening of posterior nares to end of premaxillaries,	2.68	2.75
Length of mandible from angle to symphysis, ...	3.94	4.
Height ditto from angle to coronoid process,	1.41	1.45

In form there is much resemblance between the skull of the Gilgit fox and that of a species of which the Museum possesses numerous specimens brought from Afghanistan, but said by the man from whom they were purchased to be from Bokhara.

The other fox is a very pale-coloured animal closely resembling the type of the Afghan *V. griffithi** in colour, except that the back is rather more rufous and there is a want of the black tips to the hair on the back of the neck. These differences may be due to age. The skull is smaller and the muzzle distorted. The face, front of the fore legs, outside of the hind legs, and back are rusty red, the latter dusky from the admixture of black tipped hairs. Ears sooty black. Under-fur grey with a pinkish tinge.

I believe this animal is a variety of *V. griffithi*, the small fox of Afghanistan. The larger fox I am unable to determine satisfactorily. It is allied to *V. montana*, and *V. flavescens*, and should be compared with *V. melanotus*,† or at least with the animal usually thus designated by Russian naturalists.‡

3 and 4. *Cricetus (Cricetulus) phæus*§ and *C. (Cricetulus) fulvus*||

* Blyth, J. A. S. B., 1854, XXIII, p. 730, and 1846, XIV, p. 344.

† *Canis melanotus*, Pall., Zoog. Ros. As., Vol. i, p. 44, identified by Gray with *Canis karagan*, Erxleben.

‡ *E. g.*, Severtzoff. Turkestaniske Jevotnie, p. 61;—Ann. Mag. Nat. Hist., July 1876, Ser. 4, XVIII, p. 48.

§ Pallas, *Glean.*, pp. 74, 261, Pl. XV.

|| W. Blanf., J. A. S. B., 1875, XLIV, Pt. 2, p. 108; Scientific Results, 2nd Yar. and Mission, *Mammalia*, p. 45, Pls. IX, X &.

Of the former of these species three skins have been sent by Major Bidolph, of the latter two. They thoroughly confirm the distinction between the two species, the first named being smaller and much greyer, the latter larger and more rufous. There is a corresponding difference in the size of the skulls, though very little in form; that of *C. fulvus* measures 1·17 inches long by 0·64 broad, and that of *C. phæus* 0·94 by ·48. *C. fulvus* probably weighs at least twice as much as *C. phæus*. The tail is much thicker in the former than in the latter.

5. *Mus erythronotus*.^{*} There are, amongst the Gilgit skins, two specimens of a slightly rufescent white-bellied mouse, with rather a long tail. This mouse, like the *Oriceti*, is evidently the same as a species of which specimens were brought by Dr Stoliczka from Wakhán in the upper Oxus valley in 1874. I was at first disposed to identify this mouse with the European *M. sylvaticus*, but there are, I find, differences in the skulls; the occipital portion and the foramen magnum in the European species being higher in proportion to the breadth, whilst the opening of the posterior nares is much narrower, the breadth being less than that of the anterior upper molar, whilst in the Wakhán skull the breadth exceeds that of the molar. In *Mus sylvaticus*, the hinder upper molar is only about a fourth of the size of the second molar, whilst in the Wakhán and Gilgit skulls the third molar is about half the size of the second. In the form of the occiput the skulls from Wakhán and Gilgit agree with the figure of the type of *M. erythronotus*, the specimens of which belonging to the Indian Museum appear unfortunately to have been mislaid. The comparison is imperfect, and it is far from improbable, with a good series of specimens, that all these races would be found to grade into typical *M. sylvaticus*, of which, it should be said, only a single skull is available for comparison.

The important fact is, however, that of the small number of rodents hitherto detected in Wakhán and Gilgit respectively, three, a mouse and two *Oriceti*, are identical, and that consequently part of the fauna of the Gilgit portion of the Indus valley differs from that of Ladák so far as known, and agrees with that of the upper Oxus.

Compared with the figure of *M. erythronotus*, the Wakhán and Gilgit mouse is rather less rufous, and the tail in the latter is distinctly dark brown above and pale below.

6. *Mus rufescens*, auct. The last specimen sent is perhaps the most remarkable of all, for it is a white-bellied, long-tailed rat of moderate size, quite undistinguishable, so far as I can see, from specimens of the common

^{*} W. Blanford, *Eastern Persia*, II, p. 84, Pl. V, fig. 3.

tree-rat of India, called *Mus rufescens* by Blyth* and Jerdon,† but greyer and less rufous than that species generally is. The skull is undistinguishable from that of Calcutta specimens. The dried skin measures about 5½ inches from nose to insertion of tail, tail (vertebræ preserved) 6 inches. The colour is greyish brown above, darker on the back owing to the prevalence of longer black-tipped hairs, white below, the edge of the white colour being distinct and well marked.

This rat is found in most parts of India, and *M. robustulus*,‡ of Burma appears to be only a variety. It also abounds in the Nicobar islands where it does much damage in the cocoa-nut trees § It is naturally surprising to find this rat in the upper Indus valley together with Central Asiatic types like *Oricetus* and *Lagomys*. Of course I do not mean to say that this long-tailed Indian tree-rat is true *Mus rufescens* of Gray, but the determination of the names of Indian rats and mice can only be attempted after a careful comparison of specimens.

X.—*A Description of some new Species of Hydroid Zoophytes from the Indian Coasts and Seas.*—By SURGEON J. ARMSTRONG, *Marine Survey Department.*

(Received 7th May,—read 4th June, 1879)

(With Plates IX, X, XI, XII.)

With the exception of a single species all the following hydroids are calyptriblastic. The one exception is *Endendrium ramosum*, which is a typical gymnoblastic zoophyte, and is especially remarkable in having the gonophores borne not upon a true blastostyle but upon atrophied hydranths from which the tentacles have disappeared.

LAPOREA ELONGATA, (nov. spec.)

(Plate IX.)

Zoophyte.—Plant-like, gregarious, dark-brown.

Trophosome.—Stems erect, simple, straight or slightly curved, 1 to 2½ inches high, pinnate, with 8 or 4 transverse annular markings immediately above the origin of each pinna, and rooted by a creeping tubular

* J. A. S. B., 1863, XXXII, p. 340.

† Mammals of India, p. 199.

‡ Blyth, J. A. S. B., XXVIII, p. 294; XXXII, p. 342; see also J. A. S. B., 1876, XLVII, pt. 2, p. 165.

§ Stray Feathers, IV, p. 433.

stolon. The pinnae are alternate, and each carries on its upper surface a monoserial row of hydrothecae, they are transversely annulated, both at their origins from the stem and immediately above the origin of each calycle. The hydrothecae are free, elongated and tubular, annulated at their origins, and with the margin of the mouth even.

Gonosome—Unknown

Habitat.—Rocks between high and low water at Pigeon Island, and Konkan Coast on the west coast of India, and at Diamond Island off the Pegu Coast in Burmah.

This very interesting form is certainly a campanularian, while its long tubular hydrothecae would indicate *Infusa* as its proper genus, a genus, however, not very well defined. I have lately had several opportunities of examining this zoophyte in a living condition; the polypites are supported on long attenuated peduncles, and have both disc and tentacles completely extruded from the hydrothecae, into the cavities of which they are only partially retractile. Although apparently tolerably extended in its distribution, it is very far from being abundant anywhere. It seems to thrive best in those localities most exposed to heavy seas and the influence of the South West Monsoon. This species and another belonging to the genus *Thumaria* are the only representatives of the Hydroid family I have met with during two seasons spent upon the coast of the Ratnágiri and Alibáb Collectorates

HALICORNARIA SETOSA (nov. spec.)

(Plate X)

Zoophyte—Stiff, erect, solitary, and of a dark-brown colour.

Trophosome.—Stem bipinnate, more or less irregularly and numerously branched, varying in height from one to five inches, rooted by an entangled mass of short fibrous filaments, and carrying closely set primary pinnae. The main stem is made up of a fasciculus of three tubes, from the central one of which an alternate series of hydrotheca-bearing pinnae arises, but the stems of the secondary pinnae, which are formed of a fasciculus of two tubes, are destitute of hydrothecae, but carry along their entire length an alternate series of ultimate hydrotheca-bearing pinnae. The ultimate pinnae are thus borne not only on the primary pinnae but also on the stem; they are closely set, alternate, of nearly equal length, and divided by joints into a series of internodes, each of which gives origin to a calycle with its nematophores. The hydrothecae are deep, flask-shaped, deeply concave in front below the lip, and correspondingly convex behind; the aperture is wide, and has the margin provided with two large lateral teeth, and two smaller ones posteriorly. The

nematophores are three in number, two lateral, which are short, blunt, divergent, and projecting slightly beyond the margin of the hydrotheca; and one mesial, which is remarkable as being provided with a lateral as well as terminal orifice, it is adnate to the base and lower third of the calycle, being free only at its extremity which projects horizontally outwards from the hydrotheca.

Gonosome.—Consists of a number of lozenge-shaped bodies filled with dark granular matter, and pointed at their free extremities; they arise on each side of the primary pinnæ in the intervals between the ultimate pinnæ.

Habitat.—Off Cape Negrais in 80 fathoms. At Cheduba Island in from 8 to 10 fathoms; off the Terrible Islands in 25 fathoms, and off Cape Comorin in 40 fathoms.

This beautiful species is closely allied to *Halicornaria bipinnata* of Allman. It has a very wide distribution, being found at intervals all along the Arrakan and Pegu Coasts, as well as off the South Coast of India. On several specimens which I examined I found the main stem provided with two parallel rows of pellucid dots, the nature of which I have hitherto been unable to determine; they are, however, most probably the optical expression of cauline nematophores. It is also remarkable in having the mesial hydrothecal nematophore provided with a lateral orifice as in *H. saecaria* (Linn. Soc. Journ, Vol XII) This species appears to afford a favourite anchoring ground for a small bivalve belonging to the genus "*Vexillum*;" most of the specimens dredged up by me were covered with this species firmly adherent by their byssi and in different stages of development.

HALICORNARIA PLUMOSA (nov. spec.)

(Plate XI)

Zoophyte.—Feathery, gregarious.

Trophosome.—Stems one to two inches in height, fascicled towards the base, of a dark brown colour, straight or gently curved, minutely pinnate and rooted by a creeping filiform stolon. The pinnæ arise alternately by jointed processes from the anterior surface of the stem; they are divided by more or less complete joints into a series of short internodes, each of which carries a calycle with its nematophores. The hydrothecæ are unilateral and borne on the upper surface of the pinnæ and sessile; they are cup-shaped and have a large and patulous orifice, the margin of which is deeply denticulated, and is especially characterized by the possession of a single long mesial tooth immediately behind and projecting above the anterior nematophore. The intrathecal ridge passes backwards

from the anterior nematophore across the lower fifth of the calycle and is prolonged into the wall of the pinna. The nematophores are only developed in connection with the hydrothecæ, they are three in number, two lateral and one mesial or anterior; the lateral are short, tubular, free and projecting; the mesial is long, adnate throughout its entire length, except at its immediate extremity, where it is free and slightly projecting.

Gonosome.—The gonothecæ arise singly from the posterior aspect of the stem near its base, they are bell-shaped and have a circular even and somewhat everted margin; the older ones present a more or less annulated or ribbed appearance.

Habitat.—In 35 to 40 fathoms off Cape Comorin, south coast of India, and in from 10 to 15 fathoms off Cheduba Island, coast of Arrakan.

DESMOSCYPHUS HUMILIS (nov. spec.)

(Plate IX)

Trophosome.—Stems gregarious, not exceeding a quarter of an inch in height, straight, simple, erect, divided by joints into a series of short internodes, each of which carries a pair of calyces, and rooted by a creeping stolon. The hydrothecæ are biserial, opposite, urceolate, the upper half free and tubular, the lower half adnate and saciform; the aperture is directed upwards and outwards, and has the margin marked by several deep denticulations.

Gonosome.—The gonothecæ are broadly tubular or slightly pyriform and with a simple margin; they are opposite, and arise by short pedicles on each side in the intervals between the calyces with which they consequently alternate.

Habitat.—Saint George's Island on the west coast of India, attached to sea-weed between high and low water marks. This species is evidently referrible to the genus *Desmoscyphus* of Allman. (Linn. Soc. Journal, Vol. XII) Although many gonangia possess clearly defined peduncles, yet at first sight some often appear to be sessile. This difference, however, is only apparent, for a closer examination shows that they are all pedunculated.

SERTULARELLA RIGOSA (nov. spec.)

(Plate X.)

Trophosome.—Stems slender, arising at short intervals from a creeping filiform stolon, unbranched, zig-zag, and divided by constrictions immediately above each calycle into a series of rather lengthened internodes each of which supports only one hydrotheca. The hydrothecæ are biserial and alternate, they are broadly tubular, but wider at the base

where alone they are adnate, being narrower at the orifice, which is square, and has the margin produced into four nearly equidistant teeth, they are all more or less deeply annulated or spirally ribbed.

Gonosome.—Unknown.

Habitat.—Off Cape Comorin in 40 fathoms, and off the Arrakan Coast in from 10 to 15 fathoms.

This hydroid bears a very close resemblance to *S tenella* of Alders, but differs from it in the stem not being twisted at the joints and in the spiral ribbing of the hydrothecæ.

THIMARIA COMPRESSA (nov. spec.)

(Plate XII.)

Trophosome.—Stems sparingly clustered, about an inch and a half in height, unfascicled, erect, more or less decidedly zig-zag, rooted by a creeping tubular stolon, and giving origin to a limited number of pinnæ. The pinnæ are alternate, few in number, and arise at regular intervals from the main stem, of which they are for a short part of the commencement of their course mere diverticula, being identical with it in structure, destitute of hydrothecæ, and with two annular constrictions marking the origin of each. The terminal nine-tenths of its length is made up of an aggregation of closely packed subalternate hydrothecæ, which are continued to its termination. Very often, however, the pinna is composed of a linear series of two or sometimes of three of the simple forms above described. The lower half of the hydrotheca is broadly tubular and adnate, the upper half is narrower, free, and projecting horizontally outwards, the aperture is oblique with the lower margin prolonged into a sharp tooth.

Gonosome.—Unknown.

Habitat.—Extremely abundant on the rocks between high and low water at Diamond Island, as well as amongst the laterite rocks on the Konkan Coast. I have also dredged it in 40 fathoms of water off Cape Comorin.

ANTENNELLA ALLMANI (nov. spec.)

(Plate XII.)

Trophosome.—Stems sparingly clustered, very slender, gently curved from base to apex, rooted by a slender filiform stolon, and attaining a height of about half an inch; they are divided by long, oblique partitions into a series of internodes, each of which carries an hydrotheca and four nematophores. The hydrothecæ are campanulate with large patulous orifices and perfectly even slightly everted margins. The nematophores are four in number on each segment of the stem, two lateral, one inferior and one superior. The lateral nematophores are quite free, long, narrow, and trumpet-shaped with a circular aperture and everted margin, from which they gradually taper down to extremely fine points, which are at-

tached, one on each side, to lateral processes of the stem, by a joint which allows the slightest motion of the water to communicate free vibratory oscillations to the nematophore. The inferior nematophore is free, tubular, much shorter than the lateral, and arising from a tumescent prominence on the stem, slightly below the base of the calycle, is directed upwards towards its anterior aspect. The superior nematophore is somewhat smaller, but in form and direction corresponds precisely with the inferior, it arises on a level with the upper margin of the calycle from the stem, which is here quite even and presents no enlargement similar to that which marks the origin of the lower nematophore.

Gonosome—Unknown

Habitat—Off Cape Comorin in 50 fathoms, and off the coast of Chuduba Island in 5 to 10 fathoms.

ENDINDRIUM RAMOSUM (NOV. SPEC.)

(Plate XII)

Trophosome—Tree-like, stem much and irregularly branched, attaining a height of $3\frac{1}{2}$ or 4 inches, fascicular and rooted by an entangled mass of short fibrous filaments, the branchlets are more or less dichotomously arranged and are all annulated at their origins.

Gonosome—Gonophores consisting of clusters of spherical bodies, filled with a granular substance. They appear not to be borne on true blastostyles, but on the bodies of atrophied hydranths from which the tentacles have disappeared.

Habitat—In 40 fathoms off Cape Comorin, and very sparingly, in from 10 to 70 fathoms, along the coast of Airakan.

XI—*Notes on the Formation of the Country passed through by the 2nd Column Tal Chotali Field Force during its march from Kala Abdullah Khán in the Khójak Pass to Lugári Bárkhán Spring of 1879—*
By LIEUT. R. C. TEMPLE, 1st Ghorkas

(With Map—Plate XIII)

General Features—There are one or two features general to the country passed through upon which it would be as well to remark before proceeding to note in detail the formations met with during the various marches.

The Glacis—The most remarkable feature to be observed all over Southern Afghanistan is the peculiar gradual slope, or *glacis*, leading up

to the foot of the hills which encompass the numerous valleys into which the country is split up. The hills, which are usually bare of trees, of course vary greatly in height and form, but uniformly at foot is this glacis or slope between them and the valley level. It varies, of course, under various circumstances as to length and height, but its presence is invariable. To the west of the Khójak Pass, where the so-called Khója Amrán Range rises some 3000 feet above the valley—the Kadanei—it is about 15 miles long and 1000 feet in height, i. e., the apparent foot of the Range is about 1000 feet higher than the real level of the valley. In the narrower valleys, such as the Gwál near Quetta, which is only 3 to 4 miles broad, the glacis on either side reaches nearly to the middle of the valley. It is generally very stony and covered with detritus from the hills. The streams over it, which are very numerous as a rule, have wide stony beds over which the water rushes with ever so much force, but to no great depth, after every heavy fall of rain. The torrents very quickly dry up, and very few of the streams have even a little water trickling in places from springs in the bed. The larger streams rush down several channels, the higher spots between which seem also to be liable to sudden and violent floods whenever a more than usually heavy fall of rain occurs in the hills above. These facts seem to lead to the hypothesis that the slopes have been formed by excessive denudation going on in the hills in consequence of their bare and treeless condition. But there seems to be another cause. Many of the hills, especially about the Pishin valley, appear to be formed of a slaty shale which is much disintegrated and split up at the surface towards the hill tops. It can be broken, or rather chipped, off easily by the hand, or even by the mere weight of the foot passing over it. The cold at the summits of these bare and exposed hills is intense; the heights being, say 7500 to 8000 feet, and it is possible that denudation is helped by the action of frost which separates the shale chips to be washed down by the next shower; and from the appearance of the hill sides it is probable that large quantities of these chips are in places brought down by every shower.

Metals.—Many parts of the country appeared to me to contain copper and iron in large quantities in the soil, but the specimens sent herewith will probably do something towards proving their presence and in what quantities they occur. There is a small isolated hill in the Dof valley, at the entrance of the Surai Pass, which appeared to me to affect the action of my prismatic compass. I have heard it asserted that gold is to be found in the quartz about the Pishin valley and the Khója Amrán Range, but I cannot say I saw any myself or any quartz likely to be auriferous.

Salts.—The soil in many places is white with nitre or salts of sorts; and this occurs in all parts of the country traversed. The water in many

places, both well and river, evidently holds salts in solution ; in some places, as in Sagar and the Trikh Kuram Pass, it is undrinkable from its saltiness.

Overgrowths—One of the most distinctive features of Southern Afghanistan is the want of trees, but this appears to me to be due more to the inhabitants than to nature. In the higher regions, *i. e.*, above 8000 feet, the hills and uplands are fairly wooded with junipers and conifers of sorts, and wherever from various reasons the country is uninhabited, as in the Surai Pass, the Hanumbár Pass and all the land between the Trikh Kuram Pass and the Han Pass the country is fairly wooded with olives, bér and bábul trees with tamarisks and a dwarf palm in the lower and damper grounds. Indeed about the Hanumbár Pass there is a forest of bér and bábul trees. There is, however, another general feature to be observed everywhere after the Bolán and Han Passes are once crossed, the presence of southernwood and camel-thorn, which is universal. Grasses also of sorts flourish in most places, so that it may be presumed that the soil is the reverse of being unproductive were any efficient system of irrigation to be introduced. And it did not appear that water is really wanting in the country if trouble and skill were used in finding it

Fossil remains—After Khwára in the Shór valley testaccan fossils abound, and the hills about the Hanokai and Han Passes may be described as being one mass of fossils, some in a wonderfully complete state of preservation, as the accompanying collection will show. They appear to be of the post-tertiary period. The same may be said of the whole country between the Han Pass and the plains *vid* the Cháchar Pass. I only saw one fossil of an animal which was picked up near Ningánd in the Ghazgai valley. (No. 203.)

Notes en Route.

North Pishin Talley.—Hills apparently of volcanic origin, basalt and shale ; quartz is found in layers between the strata which are irregular, faulty, and much folded with dips at great angles. The hills are bare and greatly scoured by water. The Pishin is an open valley about 25 miles long and 20 miles broad.

Kala Abdullah Khán.—The hills about this point are bare and somewhat bleak.

North Pishin to Badúdn.—The country along the road is intersected by a series of water channels and torrent-beds carrying down enormous quantities of detritus from the hills to the north of the valley, the land between them being much water-worn, apparently scoured after every shower and liable to sudden and violent floods.

To A'izai.—Country torrent-scoured and covered with detritus and in places much broken by the wash of the water: soil, light and sandy.

To Kháshdil Khán.—Country near the hills stony, water-washed and covered with detritus: it is intersected by several torrent beds: soil, light and sandy. About the low lands the country much broken and intersected by deep nullahs: soil, clay. The country is everywhere bare of trees.

To Sharan Káráz, N. E. Pishin.—On the glacis country stony and covered with detritus, intersected by torrent beds. Hills apparently composed of slaty shale and slate with layers of schist cropping up. Country about Sharan Káráz much broken.

Surai Pass.—The country is wild and broken, consisting of a series of conical hills of slaty shale and slate, much disintegrated at the surface, probably from the action of ice and frost.

Dof Valley.—This valley is about 15 miles long by 8 broad. The glacis and water-scoured appearance of the country is similar to that observed in the Pishin valley. Soil, light and friable and not so good as in the Pishin valley.

Gwál Valley.—Valley about 20 miles long by about 3 to 4 broad. Country much the same as before: soil, not deep, say 2 to 2½ feet deep over conglomerate, it is very light and friable.

Pinikái Hills.—The hills are apparently of conglomerate and much water-worn. They have the appearance of being formed of the detritus of a lofty range of mountains like the lower hills in the Himalayan Ranges. The soil seems to be strongly impregnated with lime.

Gurkkhai Defile.—The defile is of variable width, having high precipitous rocks of sandstone and grey limestone in the narrower places. It is broken up by low conical hills of soft red and grey clay in the wider portions.

Sagar.—The country is excessively wild and broken. Sagar is a kind of valley between high hills, but it is full of small conical hills of clay and in places of soft disintegrated shaly slate. The soil varies greatly in colour; white, grey, yellow and a bright red in the clay and bluish in the slate hills, trees are scarce.

Mosáí Pass, gorge of the R. Zadún.—Hills at first of soft shaly clay and ironstone, but in the gorge of the river Zadún they are very similar to those in Sagar, and of red, yellow and grey clays. Afterwards the hills become undulating and apparently are of sandstone.

Gorge of the R. Rod.—High mountainous limestone hills with fairly horizontal strata. The soil about Isaf Kach is sandy.

Ush Pass; Ispira Rágha.—The hills as far as Ispira Rágha seem to be composed of sandstones, clays of various colours, slate and shale,

and lime crystals of sorts abound. The country is fairly wooded with junipers, conifers and bér trees: about the Ush pass it is fairly open; about Ispira Rágha wild and hilly.

Topobargh Pass; Momand—Country same as about Ispira Rágha. Mómand is an open upland hilly plateau

Nangalúna Pass and Plateau—Country about the Pass is hilly, broken and rocky (gneiss). After the Pass the plateau is reached. It is of considerable width, but it is intersected by curious low flat-topped hills running north to south. It is wooded, as before, in the upper heights, but is bare of trees below 8000 feet. The hills appear to be composed of clays and sandstones of sorts with schist and gneiss cropping up in places.

Khwára.—After Khwára limestones begin to predominate and fossils, especially testacean, to abound

Chimján—The country is waterscoured, stony and treeless.

Mt. Syággai—Mt Syággai is a curious isolated mountain in the middle of the Shór valley. It rises about 1000 feet above the valley and almost perpendicularly for the last 300 feet. It is flat-topped, measuring at top about 2½ miles in length by about ½ mile in breadth. It is of limestone and full of fossils even at the summit. Fossils abound also about Chimján.

R. Zaghlun to Pálkas Pass—The country is here remarkable for five almost parallel lines of hills about one mile to 1½ miles apart enclosing hilly valleys. After these the country to the north is mountainous as far as the Zhób valley, 12 miles. The hills appear to be of limestone with trap in the gorges. The strata are very much broken and faulty.

Shór Valley.—Country much water-worn and very stony. The valley is about 20 miles long and about 5 to 15 miles broad.

Mzarai Valley.—The country much as before, but cut into by deep nullah beds.

Baidnai Pass.—Hills of soft white limestone. Country wild and rugged, much cut into by nullahs which are full of limestone chips from the hills, white, greenish and reddish.

Ghazgai Valley.—Valley 15 miles long by about 5 broad. Country as before, but more grass and overgrowths. Soil, richer than heretofore. Hills of limestone with very folded strata.

Borai Valley.—This valley is, say, 40 miles long and from 8 to 15 miles broad. The soil is good and fertile; there is no water-scour except about the streams; putt and kunker are found in the lower lands. Hills of limestone with very broken strata.

Hanumbár Pass.—Country *en route* various; putt and rough stony water-worn places, especially about the rivers, of which 4 or 5 meet in the Pass, which appears to be the only outlet southwards for some distance

along the hills south of the Borai valley. In the Pass the country is wild, hilly and wooded. There is forest land to the south of the Pass and much grass. The hills are of limestone with much folded strata in which fossils abound.

Sarghar Valley.—At first forest land is met with and then an open putt plain some 10 miles across: the soil is fertile.

Trikh Kuram Pass.—Country wild, hilly and much broken. The hills are apparently of limestone in which fossils and crystal abound. Gypsum crystals show themselves and often they are abundant.

Dérama Valley; Kuta Valley.—These are grassy upland plains much intersected by stony beds of torrents.

Jarai Tang Pass.—This is a very stony, but short, passage through a hard limestone hill.

Tsamulang Valley.—Country, putt crossed by deep river channels, but stony in places. The valley is about, say, 40 miles long by about 7 broad.

Hanokdi Pass.—The Pass is at first very narrow with precipitous sides through a limestone hill; it then opens into a broader valley which is, say, half a mile wide, but full of low conical hills which in places appear to be formed of disintegrated white limestone, the rock being very friable. Sea-shells not fossilized, especially oysters, were found all through this Pass. Gypsum is abundant, so also are fossils. The hills are of soft limestone, the strata being horizontal.

Jurndi Pass and Valley.—Hills of soft limestone. Country wild and lumpy, and it might be described as being one mass of testacean fossils in a good state of preservation. The same remark applies to the country from this point to the Indian plains, some 150 miles as the road goes. A series of parallel valleys seems to run from the Derama hills to the Jándhrán hills, all more or less resembling each other.

Bála Dháka.—This is an open valley with low rolling hills at the northern end. The general formation of the country seems to be of limestone of more or less hardness.

Hán Pass.—In the Bala Dháki Pass the rocks are hard limestone and precipitous with broken strata: in the Han Pass the strata are horizontal and the rocks softer, and there is much loose earth and clay full of nummulites and testacean fossils of all descriptions. In fact, the whole, hills and country, is a mass of fossil remains. In the Han Pass the country is wild and lumpy.

Chor Turap Ravine.—The Chór Turap ravine is curious. It is a sharply cut, narrow defile in a line of hills from 10 to 30 yards wide and, say, 200 yards long. The sides are full of fossils.

Bárhán (properly Bárhóm).—When once the Han Pass is crossed

there is a remarkable change in the country, like the inhabitants, it becomes Belóch in form. The glacis, so remarkable in all parts of South Afghanistan, now disappears and the hills stand out sharp in a flat desert-like valley. The valleys are of putt in which the vegetation is in tufts and has the same character as that observable anywhere in the Belóch plains. The country seems to be of limestone formation and fossils abound everywhere, even in the putt. In the hills the strata as usual are horizontal in some places and much folded and faulty in others.

Oháchar Pass.—The above description applies to the whole country between Bárkhán and the plains. It consists of a series of valleys and mountain ranges of more or less breadth, all of limestones, soft and hard and of all colours. Fossils are abundant everywhere, on the hill sides, in the soil and in the river-beds.

Itinerary.

No. of Stage.	Name.	Distance. miles.	Height above sea level.
	<i>From Kala Abdullah Khán to</i>		
1.	Badwan,	6½	5600
2.	Alizai,	19	5500
3.	Khúshdil Khán,	30	5600
4.	Sharan Káréz,	36½	6300
5.	Balozai Káréz,	45	6600
	<i>1st Excursion. Gwál, 10. m. 6100.</i>		
	<i>2nd " Amadún 15. m. 6300.</i>		
6.	Isaf Kach,	54½	9400
7.	Ispira Rágha,	70½	7800
8.	Khwára,	83½	7900
9.	Chimján,	90½	7400
	<i>3rd Excursion. Pálkai Pass 10 m. 8500.</i>		
10.	Baiánai,	112½	6500
11.	Ningánd,	121½	5700
12.	Wariágai,	134½	4800
13.	Sharan,	150½	4300
14.	Hanumbár Pass,	162½	3800
15.	Trikh Kuram Pass,	180½	4100
16.	Tamaulang,	198½	4000
17.	Bála Dháka,	207½	4100
18.	Mitthí Khúin,	223½	3900
19.	Lugári Bárkhán,	236½	3100

XII.—*Notes on a collection of Reptiles and Frogs from the neighbourhood of Ellore and Dumagudem.*—By W. T. BLANFORD, F. R. S., &c.

(Received August 3rd; read August 6th, 1879.)

In the year 1871 I was engaged for some months in the Godávári valley near the first barrier, and in the country between Dumagudem and Ellore. Dumagudem is the station where the Engineers, engaged on the works connected with the first barrier, used to live.

The country is herpetologically but poorly known, and the following list of the species noticed may therefore be an addition to geographical distribution. Nearly the whole tract is covered with thin forest, and the soil is very sandy.

A portion of the collection made has been lost or mislaid, and cannot now be found. The list appended is doubtless very imperfect; several common forms, such as *Naja tripudians*, *Ptyas mucosus*, *Dendrophis picta*, *Lycodon aulicus*, &c., not being included, although they undoubtedly occur. The collection was made in the driest months of the year, from February to May, and the list of lizards is consequently, in all probability, much more nearly complete than that of snakes or *Batrachia*.

REPTILIA.

CHELONIA.

1. TESTUDO ELEGANS.

2. *PANGSHURA TECTA* var. *INTERMEDIA*, J. A. S. B., XXXIX, 1870, Pt. 2, p. 339. The Godávári form is similar to that found in the Mahánadi. The natives, who eat several kinds of freshwater tortoise, will not feed on this species, as they say it makes them ill.

3. BATAGUR ELLIOTI ? Godávári river.

The only specimen obtained was about 6 inches long. The head was dusky brown with 4 broad blackish indistinct longitudinal bands on the nape and back of the neck. Legs dusky grey. Claws pale yellowish.

4. *TRIONYX* sp. ? Godávári. My specimens are not now available for comparison, but Dr. Anderson tells me he believes the species to be *T. leithi*. It is probable that more than one species are found in the Godávári. The only specimens of *Trionyx* obtained by me were young individuals. They were olive in colour with 4 ocelli on the back, white beneath, nape ferruginous with violet streaks. Tubercles on the carapace rather large.

Some individuals of *Trionyx* or one of the allied genera grow to an enormous size, I was assured that a freshwater turtle 6 feet long was caught in the Godávári by the Captain of one of the river steamers. I cannot answer for

the accuracy of the measurement; a foot or two may have been thrown in. But I once saw, on the Indus, a very large individual belonging to some species of the *Trionyxidae* basking on a sandbank. I was on a steamboat, and the turtle took refuge in the water before the vessel was sufficiently near to enable his dimensions to be accurately estimated, but my impression was, that the carapace could not have been much less than 5 feet long, and it might well have been more.

5. *EMYDA VITTATA*. One specimen was obtained on the 18th March in forest, far from water. This individual probably came from a tank that had dried up. Other specimens were procured from the Godávari river. None exceeded about 5 inches in length, and in all, the odd osseous plate in the middle of the sternum was concealed, if present. I did not, however, macerate or dissect a specimen, and I have none remaining now to examine.

CROCODILIA.

6. *CROCODILUS* sp. I do not know what is the species common in the Godávari, as I never had an opportunity of identifying a specimen. It is by no means improbable that more than one species occur in the river.

The Gharial is not found in the Godávari, nor, so far as I know, in any of the rivers of the Peninsula further South; nor is it found in the Nerbudda or Tapti. It is common, however, in the Mahánadi of Raipur, Sambalpur and Orissa.

LACERTILIA.

7. *VARANUS LUNATUS*. I twice obtained specimens of this monitor, or at least of a species which I believe to be *V. lunatus*,* in the country north of Ellore. The largest, a male, measured 23.5 inches, of which the tail from the anus was 14.5. There were about 110 cross rows of scales from the gular fold to the loin. The following is a description of the fresh colouration. Above brownish olive, with irregular cross rows of minute whitish spots on the back, passing into ill-marked cross bands behind. Tail dark near tip, the anterior portion somewhat irregularly spotted with dusky. Limbs finely dotted with yellow, the spots on the hind limbs surrounded with dusky. Lower parts irregularly mottled with yellow and pinkish brown. There is a tendency to ocellation on the side behind the shoulder. The dark colour of the upper parts passes gradually into the paler tints of the lower. Iris yellow, pupil circular. The reversed V-shaped dark cross bands, on the neck, supposed to be characteristic of *V. lunatus*, were not observed. This species is purely terrestrial, so far as my observations go, and lives in holes at the roots of trees, and in similar places far from water. It is diurnal in its habits.

* See following paper on *Ajmore Reptiles*.

8. *CABRITA LESCHENAULTII*, (J. A. S. B., XXXIX, 1870, Pt. 2, p. 345). Not rare in the dry forests on the Godávári. I find I was in error after all in supposing that *O. leschenaultii* and *O. brunnea*, are distinct; (see Günther P. Z. S., 1875, p. 225, and some notes by myself, P. Z. S., 1876, p. 685).

Up to April the only individuals I observed were adults, but in that month I found great numbers of young. These are coloured much like the adult, but the tints are brighter, and the distal portion of the tail is light orange, the head shields are quite smooth, not corrugated as in older individuals, and there were two post-nasals in all the specimens I examined under 8 inches in length. Afterwards, in May, I obtained many rather more grown, from 3½ to 4½ inches long, with but one post-nasal. As I was moving about, and procured specimens from different localities, this distinction may have been local and not due to age, but it is evident that the character of having one or two post-nasals is of no specific importance. The same variation is found in the nearly allied genus *Ophiops*.

The rugosity of the head plates appears to be a generic character of *Cabríta*.

9. *CABRITA JERDONI*, (Beddome, Mad. Monthly Jour. Med. Sci., January 1870, p. 34; Günther, P. Z. S., 1875, p. 225; W. Blanford, J. A. S. B., 1870, Pt. 2, p. 348; P. Z. S., 1876, p. 685). Dr. Günther supposed that this was the same as *Ophiops jerdoni*, but, on my sending him a specimen of the *Cabríta*, he saw, of course, that the two were quite distinct, and that he had been misled by an erroneous label.

O. jerdoni is common in the forests on the Godávári, more so I think than *O. leschenaultii*. I did not meet with *Ophiops microlepis*; it appears to be a northern and western form. (P. A. S. B., 1872, pp. 72, 74.)

10. *EUPREPES (Tiliqua) CABINATUS*.

11. *EUPREPES (Tiliqua) MACULARIUS*. (J. A. S. B., 1870, Pt. 2, p. 358; Stoliczka, J. A. S. B., 1872, Pt. 2, p. 117; P. A. S. B., 1872, p. 75.) As indicated by myself and much more clearly shewn by Dr. Stoliczka, there are two well marked varieties of this scinque, so well marked, indeed, that it is almost a question whether they should not be distinguished. The one is more slender, and more uniformly coloured above and on the sides, the other is stouter, with the posterior part of the dorsal surface distinctly spotted with black and the sides punctulated with white. In the former there are, as a rule, seven keels on each of the dorsal scales, on the latter five. The former is true *E. macularius* of Blyth, the latter, for the sake of distinction, may be called *E. macularius* var. *subunicolor* or *E. subunicolor*,* so-

* *E. macularius* var. *sub-unicolor* a type differt dorso, lateribusque parum vel haud maculatis, formâ graciliore, caudâ dorsaliâ plerumque quinguo-carinata.

ording as the distinction is considered specific or not. For the present I am by no means satisfied that the two forms do not pass into each other too gradually to render it desirable to accord them specific rank, but as one, the smaller more uniformly coloured variety, is typical of the drier climate of the Central Provinces, whilst the more highly coloured form is found in Lower Bengal, and to the eastward, some distinction in name is useful.

In the comparatively dry forests on the Godávári around Dumagudem I met with the var. *subumicolor*, whilst the typical form was obtained nearer to the sea coast in the vicinity of Rájámahendri.

It is easy to understand how naturalists who have seen but few specimens may mistake these scinques for the young of the common and very variable *E. carinatus*. A comparison of the two, however, will shew the difference. The young of *E. carinatus* has but three keels on the dorsal scales, the back is unspotted and there is a well marked pale whitish line from the superciliary region down each side of the back.

The breeding season and colouration are different in *E. carinatus* and *E. macularius*. In the former the breeding season on the Godávári appears to be March. The colouration is probably confined to the male, but I can find no notes on the sexes of the specimens examined. The colour has already been described by me (J. A. S. B., 1870, Pt. 2, p. 357). When most fully developed the lower parts are rich gamboge yellow with a broad scarlet band on each side of the abdomen from shoulder to thigh.

E. macularius breeds in May, and towards the end of that month I captured richly coloured specimens between Dumagudem and Rájámahendri. In these the deepest seasonal tints were on the sides of the neck and breast. A scarlet band covered the lower labials and extended to the upper labials and rostral; it became very broad beneath the ears, and more broken and patchy behind, but it was traceable as far as the thigh. In less fully coloured individuals the red colouration did not extend behind the shoulder. All the lower parts had a slight reddish tinge, but no trace of the bright yellow of *E. carinatus*.

12. *BIOPA ALBOPUNCTATA*.

13. *B. HARDWICKEL*. Both these species were obtained on the Godávári, but neither appeared to be very abundant.

14. *HEMIDACTYLUS SUBTRIENDRUS*. See Stoliczka, J. A. S. B., 1872, Pt. 2, p. 93. Near Ellere.

15. *H. MACULATUS*.

16. *H. LESCHENAUITII*. P. A. S. B., 1871, p. 173; Stoliczka, J. A. S. B., 1872, Pt. 2, p. 97.

17. *H. giganteus*, Stoliczka, J. A. S. B., 1872, Pt. 2, p. 99; Günther, P. Z. S., 1875, p. 223; W. Blanford, P. Z. S., 1876, p. 686.

Of these species of *Hemidactylus* I made over my specimens to Dr. Stoliczka for description. Dr. Günther considers *H. giganteus* a variety of *H. ootai*, but I have shewn that, so far as Indian specimens of the latter are concerned, there are well marked distinctions.

18. *SITANA PONDICERIANA*. The smaller race only. I saw none with the brilliant colours of the gular appendage developed up to the end of May; the colouration being, as has already been noticed, (J. A. S. B., 1870, p. 366,) purely seasonal, at all events in the smaller race.

19. *CALOTES VERSICOLOR*.

20. *CHARASIA BLANFORDIANA*, Stoliczka, J. A. S. B., 1872, p. 110. Without a much better series for comparison than I possess, I am not prepared to say whether this northern form can be distinguished from the southern race with rather smaller scales found in Mysore and further south. Specimens from the neighbourhood of the Godáviri have about 100 scales round the middle of the body. Common on rocks.

21. *CHAMELEO CEYLONICUS*. Common.

OPHIDIA.

22. *TYPHLOPS BRAMINUS*. On two occasions I found great numbers of this blind snake in decayed wood; in one case there must have been at least a hundred in one fallen tree. None exceeded $5\frac{1}{2}$ inches in length. No other species of *Typhlops* was observed.

23. *ONYCHOCEPHALUS ACUTUS*.

24. *OLIGODON SUBGRISEUS*? The only important distinction from the description of this species shewn by the single specimen collected consists in the presence of two præoculars instead of one. The following is a description of the snake.

Scales of body smooth, in 15 rows. Ventrals 185, anal divided, subcaudals in 40 pairs. Length $17\frac{1}{2}$ inches, of which the tail was $2\frac{1}{2}$.

Seven upper labials, 8rd and 4th entering the orbit; 2 præ- and 2 post-oculars; a small square loreal.

Colouration, when fresh, light yellowish brown above, with a narrow pale line along the middle of the back from head to tail, and two broader pale lines, each as wide as two scales, down each side from head to anus; below these is a narrow dark line, then pale again. There are rudimentary cross-markings on the back, due to rows of scales with black margins alternating with other rows that are white-edged. On the head the markings are faint, a dark cross-band from eye to eye, edged behind with whitish,

and a double rather broad V-shaped mark, with the angle directed forward, on the vertical and occipitals.

25. *SIMOTES RUSSELLI*. One young specimen only.

26. *ABLATES HUMBERTI*, var. (P. A. S. B., 1871, p. 174). Several specimens were obtained, in the neighbourhood of Ellore, of a small snake, only differing from South Indian specimens of *A. humberti*, in the number of ventral shields. To this variation I called attention in the short paper above indicated. The following is a description of the fresh colouration in the snake from Ellore.

Back pale coppery, sides lilac grey, lower parts very pale apple green; a series of small black dots along the middle of the back, at rather irregular intervals, from 2 to 5 scales apart, and two other lateral rows, one on each side of the ventral scales, consisting of a black dot on the side of each scale. An imperfect very narrow black streak runs down each side of the back. Head above mostly black, with a narrow yellow collar across the neck 7 scales behind the occipitals, this collar becomes broader at the sides. There is a patch of dusker yellow behind each occipital, the two patches separated by a central black line; from each patch a white band leads down to the upper labials. A white band runs along the upper labials and rostral, extending all round the upper jaw, and another runs from the rostral to each superciliary shield. Loreal region black. Each of the lower labials and chin shields with a white patch, bordered by black, anterior ventral shields with partial dusky margins. The specimen described was 10.5 inches long, the tail being 1.9. Ventrals 211, anal bifid, subcaudals in 56 pairs. In another specimen 19½ inches long there were 209 ventrals. As was pointed out in the note already quoted, there were only 155 ventrals in a specimen from Malabar, 175 in one noticed in Günther's *Reptiles of British India*, p. 228, and no less than 240 in a Calcutta example. So great a variation in the number of ventral shields might indicate that several species are included, but there appeared no other constant difference in the specimens, and I may add that Dr. Stoliczka, who also examined them, agreed with me in classing all as varieties of one species.

27. *ZAMENIS FASCIOLATUS*. A young specimen only, but one of the fiercest snakes I ever captured.

28. *TROPIDONOTUS STOLATUS*.

29. *CERBERUS RHYNCHOPS*, abundant in the salt water inlets and estuaries near Cocoonada, living in holes in the mud between tidemarks. A very gentle snake, not biting when handled.

30. *DIPSAS TRIGONATA*. The colouration varies in this snake. The specimen obtained had the head markings different from those described by Günther and on the back were irregular transverse whitish bands with

broad black edges; the median line being deficient, as in the specimens from Agra mentioned by Dr. Stoliczka, (J. A. S. B., 1870, p. 142).

81. *GONGYLOPHIS CONICUS*. Two specimens were obtained on the Godávári, they were very gentle and slow in their movements, like *Eryx*. One had swallowed a mouse. In a specimen 20 inches long, of which the tail measured $1\frac{1}{2}$, there were 168 ventral scales and 18 subcaudals; the upper labials were 14, not 12. The colour was dark brown, with the blotches light brown in the middle and yellow on the margins.

82. *DABOIA RUSSELLI*.

83. *ECHIS CARINATA*. This was obtained on two or three occasions in forest,—rather thin forest it is true,—but it is remarkable to find a desert form like *Echis carinata*, so common in the barren plains and rocky hills of South-Western Asia, in a wooded country.

AMPHIBIA.

1. *RANA TIGRINA*.
2. *R. LYMNOCHARIS*.
3. *R. CYANOPHLYCTIS*.
4. *PYXIOCEPHALUS BREVICEPS*.
5. *BUFO MELANOSTICTUS*.
6. *POLYPEDATES MACULATUS*.

7. *CALLULA VARIEGATA*, Stoliczka, P. A. S. B., 1872, p. 111. I obtained altogether five specimens of this species, from under logs of wood, near a village between Dumagudem and Rájámahendri. In size they varied from 1.1 to 1.35 in the length of the body, and the hind limb ranged from 1.23 in the smallest to 1.48 in the largest example. Four were under one log, one under another, and in each case the toads associated with a large scorpion, and tried to escape into his burrow when the log was lifted. They can hop but very feebly indeed. The body in life is extremely soft and slimy. The colour above, in the living animal, is dark brown, spotted with pale greenish or yellow, the spots are usually minute on the hinder part of the body and on the limbs, but form larger blotches on the back. The lower parts are dull flesh-colour.

XIII.—Preliminary Notice of a new Genus (*Parectatosoma*) of Phasmids from Madagascar, with brief Descriptions of its two Species.—By J. WOOD-MASON.

The interesting and remarkable animals briefly noticed below formed part of a large collection of insects, chiefly Coleoptera, recently received in London from Madagascar, and I was fortunate, while at home on furlough, to secure specimens of them from Mr. E. W. Janson, the well-known Natural History Agent.

They are unquestionably nearly related to *Ectatosoma*, an Australian genus, the three known members of which are three of the most curious and striking forms comprised in the whole class Insecta. This relationship I have indicated in the name of the new genus which the differences presented by these insects compel me to propose for their reception.

PARECTATOSOMA,* gen. nov.

Closely allied to the Australian genus *Ectatosoma*, but differing therefrom in the following characters.—the prothorax is relatively longer and more spiny, the male is devoid of ocelli, and, like the female, brachypterous; the abbreviated tegmina in both sexes are shorter than the abbreviated wings; and the upper crest of all the femora is produced into a sharp genual spine.

Of the species of the Australian genus, *Ectatosoma bufonium*, Westw., is the one which the Madagascar forms most nearly approach.

1. *Parectatosoma hystrix*, n. sp.

♂ ♀. Head armed with 12 spines (besides scattered spinules) arranged in four longitudinal rows and in pairs, of which one is large, compressed, and thorny, and constitutes the conspicuous cephalic horns; the pair of spines immediately in front of these is also compound, each being provided with a sharp spine-like cusp in front. The postantennary pair of spines is as well-developed as in *Ectatosoma*.

Sides and upper surface of prothorax strongly armed with thorns, some of which are double. The apices of the small tegmina barely reaching the bases of the wings, the true metanotum is consequently exposed and armed at the middle of its hinder margin with a pair of stout thorns. The tergum of the 1st somite and the terga of more or fewer (according to sex) of the remaining abdominal somites provided at their hinder extremities with two cross rows of spines. Posterior margin of tergum of last abdominal somite in the ♀ symmetrically divided into six spinous processes.

* From *rapé*, by the side of, and *Ectatosoma*, generic name.

Colour—deep black-brown, almost black, blotched with yellow, sparingly so on the undersurface and legs, but more profusely on the pronotum and on the terga of the abdominal somites, on which parts the colour assumes an orange tinge and extends to the points of the spines; the antennæ are ringed at the joints with the same colour; organs of flight, greenish yellow, with their bases and principal nervures black.

♂. Length of body 61 millims., of head 7, pronotum 5, mesonotum 14, metanotum 7, abdomen $25 + 7 = 32$, tegmina 2.5, wings 8, fore femur 17, tibia 17.25, intermediate femur 13.5, tibia 15.5, posterior femur 17, tibia 21, antennæ 58.

♀. Length of body 86 millims., of head 10, pronotum 7, mesonotum 18, metanotum 10, abdomen $31.5 + 12.5 = 44$, tegmina 4.5, wings 10.5, fore femur 19, tibia 20, intermediate femur 16, tibia 18, posterior femur 21, tibia 25, antennæ imperfect.

Hab.—3 ♂ and 3 ♀ from Fianarantsoa; and 1 ♀ from Antananarivo, Madagascar, differing from the rest only in being much more variegated.

2. *Parectatosoma echinus*, n. sp.

♂ ♀. Slenderer, and less numerously and less strongly spined than the preceding. Head armed: ♀ with 10 spines besides spinules, the cephalic horns more foliaceous and more sharply spined, with only one pair of spines in front of them instead of two and that simple: ♂ with 8 only, one of the lateral pairs not being developed. Postantennary spines reduced to minute tubercles. Vestiges of wings and tegmina larger, those of the latter overlapping one another, and those of the former so as to conceal from view all but about one square millimetre of the unarmed metanotum. The tergum of the 1st abdominal somite with but one row of spines at its hinder end; that of the terminal somite ♀ divided at its posterior margin into four spinous processes.

Colour—body brown like rotten leaves, with the legs, antennæ, organs of flight (which have their principal nervures darker), and spines lighter.

♂. Length of body 64 millims., head 4.5, pronotum 4.5, mesonotum 14, metanotum 6, abdomen $27.25 + 8.5 = 35.75$, tegmina 3.75, wings 7.3, fore femur 17, tibia 17, intermediate femur 12.5, tibia 13.5, posterior femur 17.5, tibia 19.5, antennæ 47.

♀. Length of body 80 millims., head 7, pronotum 6.5, mesonotum 16.5, metanotum 8, abdomen $31 + 12 = 43$, tegmina 6, wings 11, fore femur 16.6, tibia 17, intermediate femur 12.5, tibia 13.6, posterior femur 18, tibia 21, antennæ 43.5.

The fore legs and all the tibiae in the male of this species are nearly quite simple.

Hab.—1 ♂ and 2 ♀ from Fianarantsoa.

CONTENTS

OF THE NATURAL HISTORY PART (PT. II.) OF THE JOURNAL OF THE ASIATIC SOCIETY OF BENGAL FOR 1878.

No. 1, (issued May 24th, 1878). *Description of Ruticilla schisticeps* *Hodge*—By W. T. BLANFORD. *Aberrant Dentition of Felis Tigris*.—By R. LYDEKKER. *Record of the Occurrence of Earthquakes in Assam during 1877*—Communicated by COLONEL R. H. KEATINGE. *Sixth List of Birds from the Hill Ranges of the North-East Frontier of India*.—By MAJOR H. H. GODWIN-AUSTEN—*An Account of the Tidal Observations in the Gulf of Outch, conducted by the Great Trigonometrical Survey under the superintendence of COLONEL J. T. WALKER. Compiled from the G. T. Survey Reports by CAPT. J. WATERHOUSE.*

No. 2, (issued July 10th, 1878). *The Application of Photography to the Reproduction of Maps and Plans by Photo-mechanical and other processes*.—By CAPT J. WATERHOUSE; (with one Plate).

No. 3, (issued Oct. 28th, 1878). *Notes on some Reptilia from the Himalayas and Burma*—By W. T. BLANFORD. *Notes on the Earthquake in the Punjab of March 2nd, 1878*—By A. B. WYNNE. *Notes on the Land and Fresh-water shells of Kashmir, more particularly of the Jhelum valley below Srinagar and the hills North of Jammu*.—By W. THEOBALD. *On some Mammals from Tenasserim*.—By W. T. BLANFORD, (with three plates). *List of Hymenoptera obtained by OSSIAN LIMBORG, east of Maulmain, Tenasserim Provinces, during the months of December 1876, January, March, and April 1877, with descriptions of new species*:—by F. SMITH. Communicated by J. WOOD-MASON. *Preliminary Diagnoses of new Coleopterous Insects belonging to the families Dytiscidae, Staphylinidae, and Scarabaeidae, obtained by the late F. STOLIOZKA during the 2nd Mission to Yarkand under SIR DOUGLAS FORSYTH*.—By D. SHARP.

No. 4, (issued April 6th, 1879). *Description of a new Lepidopterous Insect belonging to the genus Thaumatia*.—By J. WOOD-MASON. *Great Snow-fall in Kashmir*.—By R. LYDEKKER. *Physiographical Notes on Tanjore (Tanjikér)*.—By Lt.-COL. B. B. BRANFILL, Deputy Superintendent, Great Trigonometrical Branch, Survey of India. Communicated by COLONEL J. T. WALKER.—*On the proper relative Sectional Areas for Copper and Iron Lightning rods*.—By R. S. BROUGE. *Description of a New Homopterous Insect belonging to the Genus Cosmocarta*.—By W. L. DIFRANT. *On the Indian Species of the Genus Erinna*.—By J. ANDERSON.—*Description of a supposed new Hedydactylus from Muscat in Arabia*.—By W. T. BLANFORD. *On Arvicola indica, Gray, and its relations to the Sub-Genus Nesokia, with a description of the species of Nesokia*.—By J. ANDERSON.

PUBLICATIONS

FOR SALE AT THE

ASIATIC SOCIETY OF BENGAL,

No. 57, Park Street, Calcutta.

	RS.	AS.
Journal, Asiatic Society, Bengal, from Vols XII to XVII (1848 to 1848); Vols. XIX to XXII (1850 to 1852); Vols XXVI, XXVII (1857, 1858), and Vols. XXXIII to XLIV, (1864 to 1875).		
Asiatic Researches, from Vols. VI to XII and Vols. XVII to XX, each at	10	0
Ditto ditto, Index,	5	0
Catalogue of the Books and Maps in the Library of the Asiatic Society, 1856,	3	0
— of Sanskrit Books and MSS in ditto,	1	0
— of Books and MSS. in Arabic, Persian, and Urdu,	1	0
The Ain-i-Akbari, Vol. I. Translated into English, with notes and indexes, by H. Blochmann, M. A.,	12	4
The Prosody of the Persians.—By H. Blochmann, M. A.	5	0
The Tabaqat-i-Nasiri. Translated by Major H. G. Bawerty, 8 fasc., 3 Vols. 8vo., Rs. 32, (exclusive of packing and postage).	8	0
Aborigines of India, by B. H. Hodgson, Esq., B. C. S.,	3	0
The Antiquities of Orissa, Vol. I.—By Rajendralala Mitra,	35	0

Now Ready.

UNDER SUPERVISION OF MAJOR H. H. GODWIN-AUSTEN.

REPRINT OF

JERDON'S BIRDS OF INDIA.

To which have been added his "Supplementary Notes" to the above work, published in the "Ibis." These extend the Catalogue of the Indian Avifauna considerably to the Eastward of the Teesta and Brahmaputra Rivers, or the Eastern limit laid down in Dr. Jerdon's original work, 3 Vols. 8vo., Rs. 32, (exclusive of packing and postage).

As only a limited number of copies have been printed, early application should be made to

P. S. D'ROZARIO & Co.,

Publishers,

12, Waterman Street, Calcutta.

Remittances to be made payable to Manager, Agre Bank, "Limited."

NEW SERIES

VOL. XLVIII

No. CCXXVIII.

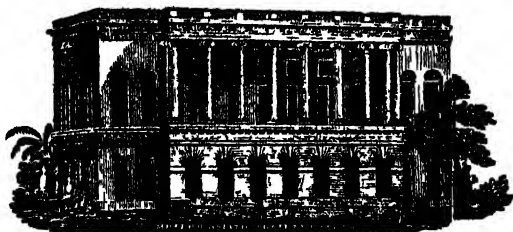
JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL,

Vol. XLVIII, Part II. No. III.—1879.

EDITED BY
THE GENERAL SECRETARY.



"The bounds of its investigation will be the geographical limits of Asia and within these limits its inquiries will be extended to whatever is performed by man or produced by nature"—SIR WILLIAM JONES.

* * * Communications should be sent under cover to the Secretaries, *Asiat. Soc.*, to whom all orders for the work are to be addressed in India; or, in London, care of Messrs. Trübner and Co., 57 & 59, Ludgate Hill.

CALCUTTA:

PRINTED BY G. H. ROUSE, AT THE BAPTIST MISSION PRESS,
AND PUBLISHED BY THE
ASIATIC SOCIETY, 57, PARK STREET.
1879.

*Prices for copies of papers to subscribers, Rs. 1-4.—The Non-Subscribers, Rs. 1.
Price in England, 4 shillings.*

Issued 25th November, 1879.

CONTENTS.

	<i>Page</i>
XIV.— <i>Notes on a collection of Reptiles made by MAJOR O. B. ST. JOHN, R. E., at Ajmere in Rájputáná.—By W. T. BLANFORD, F. R. S., &c.,</i>	119
XV.— <i>Notes on Reptilia.—By W. T. BLANFORD, F. R. S., &c.,</i>	127
XVI.— <i>Notes on stone Implements from the Khasi Hills, and the Banda and Vellore Districts —By JOHN COCKBURN, Late Curator of the Allahábd Muscum, Officiating Assistant Osteologist, Indian Museum, Calcutta, (with 3 plates),</i>	133
XVII.— <i>The Ravages of Rats and Mice in the Dakhan during the Harvest of 1878-79.—By the REV. S. B. FAIRBANK, D. D.,</i> ..	143
XVIII.— <i>Notes on the Survey Operations in Afghanistan in connection with the Campaign of 1878-79. Compiled from Letters and Diaries of the Survey officers by MAJOR J. WATFHOUSE, Assistant Surveyor General.—Communicated by MAJOR-GENERAL J. T. WALKER, R. E., C. B., Surveyor General of India, (with Map),</i> ..	146

Just Published,

HISTORY OF THE BIRDS OF CEYLON.

PART I.

BY CAPTAIN W. V. LEGGE, R. A., F. L. S.

345 pages, Royal 4to., with 10 plates by Keulemans. To be completed in two more parts, price £2 each. In this work the geographical range, habits and nidification of each species is fully worked out.

Intending subscribers should communicate with the author, whose address is Aberystwith, Wales.

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.

Part II.—PHYSICAL SCIENCE.

No. III.—1879.

XIV — *Notes on a collection of Reptiles made by MAJOR O. B. ST. JOHN, R. E., at Ajmere in Rájputána — By W. T. BLANFORD, F. R. S., &c.*
(Received and read August 6th, 1879.)

The following is a list of the reptiles obtained by Major St. John in the neighbourhood of Ajmere during about three years of residence. Most of the species were identified by the discoverer, but nearly all were sent to me for comparison. The list is small, and the fauna of the country is evidently poor, but still all local lists of this kind are of importance, especially if they approach completeness, as they afford very valuable aid towards a knowledge of distribution. In this list, for instance, I find that two species occur, *Cynophis helena* and *Python molurus*, belonging to two genera the existence of which in any part of Central or Northern India I previously thought extremely doubtful.*

The species marked with an asterisk are inserted from information sent to me by Major St. John, as I have not seen specimens. All others have been examined by myself.

*1. TESTUDO ELEGANS.

*2. CROCODILUS, sp. Major St. John writes: "Crocodiles (*C. palustris*, I suppose) are very numerous in the natural lake of Pushkar (or Pohkar) 6 miles from Ajmere. Some are also found in the artificial lake at Ajmere called the Anaságar; they are said not to breed there, but to

* Ann. Mag. Nat. Hist., October 1876, Ser. 4, Vol. XVIII, p. 292.

find their way over the ghat from the natural lake. I cannot hear of the existence of Crocodiles elsewhere in these parts, though they are found in a small tank in the Chittore hill fort, 100 miles to the south."

I identified the species found in Sind with *O. palustris*, and it is not improbable that the Ajmere crocodile may be the same. We are badly in want of a careful collection and comparison of Indian crocodiles; small specimens 2 or 3 feet long would be of service.

8. *VARANUS LUNATUS* ?

Three young specimens have been sent to me by Major St. John; they are respectively 19, 14 and 8½ inches long. In the first I count 114 scales from the gular fold to the loin, in the second 98, in the third 104. Owing to the irregularity of the anterior scales, the number is not quite constant, but having counted the rows in each case two or three times, I only find a difference of one or two.

The colouration is also different in all three. The largest specimen is much darker than the others; yellowish brown in spirit, with small black spots more or less regularly arranged in transverse lines on the back, and narrow blackish cross lines on the neck. A few white spots, generally very small, are scattered quite irregularly over parts of the back, sides, limbs and tail. A black line from the back of the eye over the ear to the side of the nape.

The next specimen is paler yellowish brown, with cross rows of small white ocelli alternating with rows of dark spots throughout the back, and with somewhat irregular broad bands on the tail. The black line from behind the eye is less distinct.

In the smallest specimen, the ground colour is still paler, numerous dark bands cross the back and alternate with rows of minute white dots: on the tail the dark bands form rings, and are much broader than on the back; on the back of the neck the dark lines are V-shaped, the angle being directed backwards. The dark marks running back from the eyes meet on the nape, and form the first cross band. There are imperfect dark cross lines on the chin and throat.

The question arises to which species these monitors should be referred. *Varanus flavescens* and *V. nebulosus* are quite different, and it is clear that the Ajmere specimens, if they belong to a described form, must be either *V. draconis* or *V. lunatus*. The distinctions between these species are variously described by different naturalists. Gray's original description of *Varanus lunatus*, in the *Catalogue of the Specimens of Lizards in the Collection of the British Museum* (1845) p. 10, runs thus:

"Nostrils large, nearly central, (i. e., between the eye and nostril) shields over orbit small, subequal; dark brown, with lunate bands, directed backwards on the neck

and forwards on the body, and with cross bands on the tail, belly and under side of tail whitish."

While *V. heraldicus*, as Gray called *V. dracæna*, was thus described :

"Black with cross rows of pale-eyed spots, beneath pale, black-banded, shields over the orbits small, subequal"

The distinction, it will be seen, depends solely on colouration, and I may add that the colour assigned to *V. dracæna* is not that of a typical example by any means. In Gunther's "*Reptiles of British India*," the differences are far better explained. *V. dracæna* is said to have the ventral scales in 90 transverse series between the gular fold and the loin, and the neck without angular dark cross bands. In *V. lunatus* the ventral scales are said to be in 105 transverse series, and the neck to be marked with dark angular cross bands, their points being directed backwards. The following is the description of the colouring of *V. dracæna* :

"Brownish olive uniform or generally with more or less numerous black dots, each of which occupies a scale, these dots are sometimes arranged in irregular transverse series and are most numerous on the throat young specimens shew numerous small white ocelli edged darker, whilst the lower parts are marked with irregular dark transverse bands"

It is mentioned that a young specimen from the Anamullay mountains (probably from the base, not the top of the hills) shews narrow black bands across the neck, "but they are much narrower than in *V. lunatus* and rather irregular" The colouration of *V. lunatus* is said to be—

"Neck, trunk, and tail marked with cross bands, which are as broad as the interspaces of the ground colour, these bands are angular on the trunk and neck, with the angle directed backward on the neck and forwards on the trunk—four on the neck, eleven on the trunk. Sides and legs dotted with white."

The single specimen in the British Museum, from which Gray's and Gunther's description was taken, is stuffed and 25 inches in length, so that it is not in all probability full grown. It is said to have come from India, but no further information is available as to the locality. I examined this skin some years ago, when comparing the specimen from Baluchistan described in *Eastern Persia*, Vol. II, p. 360, but I could detect no character to be added to those noticed by Günther.

The matter remained thus till ten years ago. Then Carlleyle stated that both *V. dracæna* and *V. lunatus* occurred commonly near Agra, and that neither of them were "water-lizards" (J. A. S. B., 1869, Pt. 2, p. 195) Next Jerdon (P. A. S. B., March, 1870, p. 70,) stated that he found *V. lunatus* in the Museums at Delhi and Lahore. Anderson, (J. A. S. B., 1871, Pt. 2, p. 30,) recorded the receipt, by the Indian Museum, of *V. dracæna* from Calcutta, Agra, the Khairi Hills and Assam, and of *V. lunatus* from Agra and Goalpara (Assam). Dr. Stoliczka identified

the species found in Kachh with *V. draconea* (P. A. S. B., 1872, p. 78,) and I similarly referred a Baluchistan specimen to the same species.

Lastly Theobald, in his "*Descriptive Catalogue of the Reptiles of British India*," 1876, p. 88, does little more than copy Günther's characters, but gives the additional localities subsequently recorded. In his Synopsis, at the end of the volume, he distinguishes *V. draconea* as having the body black dotted, and *V. lunatus* as having the same yellow dotted; a distinction, I may at once add, with which I am unable to coincide.

So far as I know, no other specimen having the peculiar colouration exhibited by the type of *V. lunatus* has been observed. The colouration, of the neck especially, is peculiar and is shewn in Gunther's plate. All who have endeavoured to discriminate the species in India have, I think, depended on the number of rows of ventral scales, specimens with less than about 95 rows (or to speak more correctly about 70 to 75 rows on the abdomen, and 20 to 25 scales less regularly arranged on the breast) have been referred to *V. draconea*; those with 100 or more to *V. lunatus*. Stoliczka, however, referred Kachh specimens with 90 to 100 rows to *V. draconea*, and I myself, after comparing a specimen from Baluchistan having 107 rows with the series in the British Museum, came to the conclusion that it must be classed with the same species. At the same time I expressed a doubt whether *V. lunatus* was more than a variety of *V. draconea*.

On the other hand there is considerable reason for believing that the common *Varanus draconea* of Bengal and Assam is a water lizard, inhabiting marshy places and entering the water freely like *V. flavescens*. The monitors of the North-West Provinces of India, of parts of Southern and Western India are purely terrestrial, as has been noted by several observers. Many of these terrestrial lizards have been classed by various writers as *V. draconea*, and the question arises whether two species have not been confounded under this name. A second question is, whether the terrestrial lizard is not *V. lunatus*.

In the hope of determining this point, I examined all the Indian Museum specimens, which Dr. Anderson kindly placed at my disposal. The result is far from decisive, but it does appear probable that two well marked forms exist, the one inhabiting Bengal and Assam, the other ranging through the greater portion of the Indian Peninsula. The number of ventral scales is not sufficiently characteristic to serve as a distinction, although the form from the North West Provinces and Western India has decidedly smaller scales, both above and below, than the Eastern race. Indeed I have sought in vain for any well-marked character to distinguish these two. So far as I can see, the adults are easily discriminated by

colouration, and by the form of the dorsal scales. Assuming that the western form is *lunatus*, the following appear to be the distinctions.

V. dracæna. Back more rounded, and head higher. Scales throughout larger, the dorsal scales surrounded by granules, the central boss very convex, much longer than broad. The fold above the shoulder and along the side often ill-marked, and in old specimens wanting.

Colouration dusky yellow to greenish olive thickly speckled with black. In the young the dark transverse bands are broad, nearly equal to the interspaces.

V. lunatus? Back nearly flat, and head lower than in *V. dracæna*. Scales throughout smaller, notably so on the labials, and as a rule on the supra-orbital regions. The dorsal scales in adults surrounded by a broad band of granules, the central boss nearly flat, but little longer than broad. The fold above the shoulder running back nearly to the thigh, and forward on the side of the neck, well marked in young specimens, and as a rule in adults.

Colouration brownish olive to yellowish brown. Adults almost uniformly coloured or thinly dotted with black on the upper parts. In the young the transverse bands are narrower than the interspaces (the very young are indistinguishable, however, from those of *V. dracæna*).

It is not certain that the latter species is the true *V. lunatus*, but as that form has smaller scales than the typical *V. dracæna*, the monitor above described may be referred to it. Even now I am far from convinced that the two are absolutely separable.

Varanus lunatus (if this be correctly identified) is common near Ajmere.

4 OPHIOPS MICROLEPIS. (J. A. S. B., 1870, Pt. 2, p. 851; 1872, Pt. 2, p. 90; P. A. S. B., 1872, p. 74.) This seems rather a widely-spread form. The present is the fourth locality noticed, the others are Bilaspur in the Eastern Central Provinces, Karharbári in Western Bengal, and Kachh.

5. EUPREPES GUENTHERI.

E. monticola, Gunther, *Reptiles of British India*, p. 80, Pl. X, fig. C.—Stoliczka, J. A. S. B., 1872, Pt. 2, p. 120.—Theobald, *Desc. Cat. Reptiles Brit. Ind.*, p. 52.

Few people can be more loth to change a name which has subsisted for a considerable time than I am, but I think that this is clearly one of the cases to which the British Association rule, § 11, applies. That rule runs thus:—"A name may be changed, when it implies a false proposition which is likely to propagate important errors." Now the name *monticola* does imply a false proposition, for it indicates that the species so called is a

mountain form; Dr. Günther's information led him to suppose that this scinque inhabited Sikkim at an elevation of 8000 feet. Whence his information was derived is not mentioned, but Dr. Stoliczka was probably correct in attributing it to the Messrs. v. Schlagintweit, whose inaccuracy in these matters is notorious. Since the species was described, Sikkim has been searched by numerous collectors, but not a single specimen of this *Euprepes* has been found. Dr. Stoliczka noticed the improbability of this form occurring in the highlands of Sikkim, where not a single reptile found in the plains of India is known to occur, but he suggests that the specimens may have been procured in the warm valleys. It appears, however, that this scinque is an inhabitant of the dry parts of India. Major St. John has sent it from Ajmere, Mr. Theobald records it from Kálka, at the base of the barren lower Himalayas of the Punjab, and I have met with it in Upper Sind.* Now the fauna of the dry plains of Upper India is widely different from that found in the moist Sikkim valleys, and the only reptiles common to the two are a few species of enormous range, such as *Calotes versicolor* or *Naja tripudians*. I believe, therefore, that *Euprepes monticola*, like *Eryx Johnii* and *Gongylophis conicus*, owes its supposed Sikkim locality solely to an incorrect label, and therefore the retention of the name *monticola* "tends to propagate an important error." Under these circumstances I propose to re-name the species after the original describer, Dr. Günther.

Two specimens of *E. guentheri* have been sent by Major St. John; they agree with Dr. Gunther's original description in all essential particulars, and still better with Dr. Stoliczka's. There are 85 or 86 scales round the body, the dorsal scales have two keels, sometimes with a faint third keel between the two stronger ridges; lateral scales with three keels.

E. guentheri is, according to Major St. John, common near Ajmere. It lives under bushes on the hill sides and in sand.

6. *HEMIDACTYLUS TRIEDRUS*, (? *subtriedrus*). (Stoliczka, J. A. S. B., 1872, Pt. 2, p. 93.) The only specimen procured was caught on Tára-garh, close to Ajmere. There are unfortunately no specimens for comparison from Southern India in the Museum at Calcutta, and I have no longer those procured near Ellore. In the individual from Ajmere, as in those from Ellore, none of the tribedral tubercles is quite as large as the ear opening. The specimen is, unfortunately, a female, and has no femoral pores. The following are the principal characters.

Back with closely set tribedral tubercles, those in the middle a little

* I have also received from Mr. Wynne a specimen of a scinque procured in Hindia, and probably belonging to this species, but not in sufficiently good preservation to be identified with certainty.

longer than broad and arranged in longitudinal lines, those on the sides broader than long, not very regularly placed. Head above granular, with numerous small round tubercles. Tail with cross-rows of trihedral tubercles above, and broad plates below. Eight upper labials, seven lower; the nostril is separated from the first labial, but is in contact with the rostral; the plates behind the rostral are small; one pair of large chin shields only; about 34 scales across the abdomen. Scales below head and throat and those beneath the feet very small.

The general form is similar to that of *H. triedrus*, as represented in Belanger's "*Voyage*;" the head large and depressed; body stout. The length of the specimen is rather more than $2\frac{1}{2}$ inches from nose to anus, the tail, renewed in parts, is 2 inches long.

Colouration in spirit light brown above, with, on the body, 5 broad transverse yellow, black-edged bands, the margins of which are wavy; the first on the nape without a black edge in front, the hindmost between the hind legs; similar but narrower bands across the upper part of the tail. Sides of head blackish, darker behind the eye than in front, with a pale line from the nostril to the eye continued behind the eye, to the nape, and another line along the upper labials, produced by some whitish tubercles to above the ear.

7. *HEMIDACTYLUS COCTÆI*.

8. *CALOTES VERSICOLOR*.

*9. *CHAMÆLEO CEYLANICUS*.

10. *TYPHLOPS BRAMINUS*.

11. *OLIGODON SUBGRISEUS*.

12. *CYNOPHIS HELENA*. A specimen 41 inches long, agreeing very well with the description in Günther's *Reptiles*, except that the labials are more divided than usual, and the ventral shields more numerous. There are 11 upper labials on each side, the 5th, 6th and 7th entering the orbit; the præocular is large, extending to the upper surface of the head. Loreal divided into two shields, both in contact with the præocular, the anterior square, the posterior smaller, subtrigonal. Anterior frontals as long as broad. Ventrals 254; anal single; subcaudals in 75 pairs, the extreme tip of the tail having been lost.

13. *PTYAS MUCOSUS*.

14. *ZAMENIS DIADEMA*. A large specimen, 61 inches in length, agrees in most characters with Dr. Anderson's description (*P. Z. S.*, 1871, p. 174,) of the form found in the neighbourhood of Agra. There are only 27 rows of scales round the body, the dorsal series being very distinctly keeled, the angulation of the ventrals is faint, and the præocular is divided into two,

The post-frontals are united into one shield, and there are three supplementary shields behind the post-frontal, as in the Persian form, (*Eastern Persia*, II, p. 412,) and not four as is usual in Indian specimens. There are 11 upper labials on one side, and 12 on the other. Ventrals 239; anal undivided; subcaudals in 110 pairs.

The whole upper surface of the head is black, the colour extending in part to the labials, the remainder of the body is pale sandy in spirit, almost cream-coloured, pinkish anteriorly on the back, and dotted here and there with black spots, which are quite irregular both in size and distribution: (see Stoliczka, P. A. S. B., 1872, p. 82.) In life, as I learn from Major St. John, the lower parts were bright salmon pink.

15. *TROPIDONOTUS QUINCUNCIATUS*. A single young individual is sent, only 12 inches long. Uniformly coloured above olive-grey in spirits, white below; even the characteristic black marks from the eye to the labials are wanting, although the posterior band is indicated by a faint dusky line.

16. *PSAMMOPHIS CONDANABUS*. The single specimen sent appears to approach the Sind form in some respects, and especially in having the nostril between two shields (Stoliczka, P. A. S. B., 1872, p. 83). But I find in a Sind specimen that the nostril is much smaller, the orifice being diminished by a valvular prolongation of the upper portion of the post-nasal. This form leads again to *P. leithi*, in which, as I have shewn, (*Eastern Persia*, II, p. 421,) there appear to be two post-nasals.

In the Ajmere specimen the principal marking consists of 4 longitudinal equidistant dark-brown, almost black bands, two on the back and one on each side, extending from head to tail; the two upper bands coalescing on the tail. The bands are equal in breadth to the interspaces. The specimen is young; it measures only 23 inches, the tail being imperfect.

17. *DIPSAS TRIGONATA*. A small specimen only $15\frac{1}{2}$ inches long, of which the tail is but $2\frac{1}{2}$. The colouration consists of rather irregular white, black-edged patches, having a tendency to form transverse lines on the back. Ventrals 215. The tail is slightly imperfect, but only a very small portion can be missing.

In young specimens of this snake, at all events, the tail does not always amount to a fourth of the length. I find notes of two specimens from the neighbourhood of Ellore, measuring respectively $15\frac{1}{2}$ and $23\frac{1}{2}$ inches, with tails 3 and $4\frac{1}{2}$ inches long, or rather less than one-fifth in each case. In the Ajmere specimen the tail is even shorter, about one-seventh.

This snake was captured amongst stones, and had swallowed a young *Calotes versicolor*.

18. *LYCODON AULICUS*.

19. *L. STRIATUS*. Two specimens sent, one 11 inches long, the other 9½. Major St. John notices that these snakes had no yellow coloration, and suggests that the tint may be seasonal. His examples were procured early in April.

*20. *PYTHON MOLURUS*. This, as already remarked, is an unexpected addition to the fauna of Rájputána. The specimen obtained by Major St. John was 10 feet long, and was captured in bush jungle near the Pokur lake among low hills on the edge of the desert.

21. *ERYX JOHNNI*.*22. *NAJÁ TRIPDIANS*.23. *BUNGARUS CERULEUS*.24. *ECHIS CARINATA*.XV.—*Notes on Reptilia* —By W. T. BLANFORD, F. R. S., &c.

(Received and read 6th August, 1879.)

In the course of the last few years I have received small collections of reptiles from several friends in different parts of India and Burma, and I have collected some myself in Sind and its neighbourhood, and in Darjiling. Although, with the exception of one snake (*Homaloprida*) described below, none appear to be absolutely new, there are a few calling for remark on account of rarity, variation, or from the locality being previously unknown. I have thrown together these somewhat desultory notes in the following pages.

LACERTILIA.

MESALINA GUTTULATA (olim PARDALIS).

Dr. Peters informs me that the species identified with *Lacerta pardalis* of Lichtenstein by Dumeril and Bibron (*Erp. Gen.* V, p. 312) and by Gray (*Cat. Lis. Brit. Mus.* 1845, p. 43) is not Lichtenstein's species, but that it is his *L. guttulata*. I believe the original types of Lichtenstein are in the Berlin Museum and have been examined by Dr. Peters.

The species abounds in the countries west of India ('*Eastern Persia*,' II, p. 377), and was described from Sind by Dr. Stoliczka, who supposed it to be a new species which he called *Eremias (Mesalina) Watsonana* (P. A. S. B., 1872, p. 86; see also J. A. S. B., 1876, Pt. 2, p. 26). I have since found it as far to the eastward as Jaisalmir.

SPHENOCEPHALUS TRIDACTYLUS.

When in the Indian desert between Sind and Rájputána in 1876, I daily saw tracks in the sand, which I believe to have been made by this lizard; but although I heard of the animal under its name of 'Rig mahi' I never succeeded in finding specimens. I believe that it is nocturnal in its habits, as I always found the peculiar vermiform tracks in the sand, which are, I believe, produced by it, fresh in the early morning. It has been obtained from both Sind and Cutch (P. A. S. B., 1872, pp. 76, 88), but it is said to be rare. I suspect, on the contrary, that it is common, but that, from its habit of burrowing and from its not moving about during the day, it is very difficult to find.

ZYGNIDOPSIS BREVIPES.

I am indebted to my friend Major Mockler for two additional specimens of this rare lizard. The single type was procured near Karmán in Persia at an elevation of 5,500 feet; the two specimens now sent are from some part of Southern Persia or Baluchistán, probably from near the coast, but I do not know the exact locality. The head was slightly injured in the original specimen, and those now procured shew the muzzle to be more conical than it is represented in the plate in '*Eastern Persia*' (see Vol. II, p. 397, Pl. XXVII, fig. 4) and the rostral shield to be distinctly angulate in front. The tongue too is slightly cleft at the extreme end.

Another error in the figure, judging from the more perfect specimens now procured, is that the tail tapers rather more than it is represented as doing. In neither of the specimens sent is the tail perfect; in one it has been entirely lost and the new growth is only beginning, in the other the extremity has been renewed. In one specimen the hind foot is one-fourth, instead of one-fifth, the length from thigh to shoulder.

The anterior margin of the vertical and the posterior margin of the prefrontal are straight, and so is the posterior edge of the vertical, not convex as in the type. The superciliary shields are also slightly different from the figure, the third from behind being the largest and fitting into the emargination on each side of the vertical.

The coloration is paler and consists of narrow brownish longitudinal lines, the only conspicuous bands being one on each side from the nostril through the eye down the upper part of each side.

The specimens are smaller than the original type, one being 8, the other 8½ inches from nose to anus.

DRACO sp. (P. D. MAJOR, var.)

A single specimen of *Draco* of large size, sent to me by Mr. Davison, closely resembles *D. major* (J. A. S. B., 1878, XLVII, Pt. 2, p. 125), but

the hind limb just reaches the axil, the tympanum is covered with one or two large scales instead of being quite naked, and the nostrils are not directed upwards. If the last character were certain, there could be no doubt about the specific distinction of the species, but one nostril has a distorted look, and there is an opening from one nostril to the other through the septum, so that it is possible to see through both nostrils. Now the specimen having been obtained by an ornithologist, I think it has been carried, when freshly killed, suspended to a stick with a pin thrust through the nostrils—the common plan employed for carrying birds by collectors—and I am not sure how far the nostrils have been distorted by the process. The other differences are less important; in forms like *D. maculatus* with the tympanum scaly, the area is covered with small scales; and in those with a naked tympanum, part of the space is often occupied by a large flat scale.

The membrane of the 'wings' is dark-coloured, rather darker towards the margin than inside, with small spots formed of larger white scales. These spots are not arranged in as distinct rows as in typical *D. major*. Otherwise the coloration is the same in both. The length is 12 inches, of which the tail measures 8.

This may be a new species and I therefore call attention to it. I am much inclined, however, to believe it is a variety of *D. major* with the nostrils distorted.

STELLIO TUBERCULATA.

As might have been anticipated, this proves to be, in part, a vegetable feeder, like allied species. Mr. Wynne noticed some lizards feeding on leaves at Murree, and sent me a skin of this species and some of the contents of the stomach, which proved to be a mixture of fragments, partly of insects, partly of vegetables.

AGAMA AGILIS.

Dr. Peters writes to me that this species is *Agama sanguinolenta* of Pallas, and must take Pallas's name. It is also, Dr. Peters says, *A. aralensis* of Lichtenstein; the true *A. agilis* of Ollivier being a form allied to *A. (Trapelus) ruderata*. I am unable to examine into this question at present as I have not now access to Ollivier's work.

I found the lizard hitherto called *A. agilis* by myself and others (see *Eastern Persia*, II, p. 314 and J. A. S. B., 1876, pt. 2, p. 22) abundant near Jaisalmir in the sandy desert to the east of the Indus. I once or twice saw this species on low bushes, precisely as I have observed *Trapelus ruderatus* in Persia.

ACANTHOSAURA ARMATA.

I am indebted to Mr. Davison for specimens of this lizard from the neighbourhood of Moulmain and from Tavoy. Both forms differ somewhat in coloration from the published description. The Moulmain specimens are large, being nearly 12 inches long, and all the upper portions are dusky, the tail with pale rings, lower parts pale, the colour extending up the sides of the head and neck, in the former to just below the eye and in front to the *canthus rostralis* and on the neck, so that there is only a belt of black about one-eighth of an inch broad on each side of the crest; no radiating lines from the orbit over the lip. In the Tavoy specimens, which are younger, the upper parts are mottled with dusky and grey.

OPHIDIA.**HYPsirrhina MACULATA. sp. nov.**

Hypsirrhina ad H. chinensem affinis, sed squamis in 25 nec 23 series regulares longitudinales ordinatis, scutis ventralibus ad 125. Caput breve, rostrum truncatum, corpus robustum, cauda compressa. Scutum præfrontale unicum parvum, singulis postfrontalibus magnitudine secundum; præoculare unicum, postocularia duo. Color fusco-cinereascent, nigro-maculatus, abdomine albescente, fascia fusca longitudinali utrinque ad margines scutorum ventralium ornato.

Habitat in Pegu Burmanorum.

Head short, very little broader than the neck, muzzle broad, square, as if truncated, body stout, tail short compressed. Scales polished, rhombic, in twenty-five very regular series. Ventrals narrow 125, anal bifid, subcaudals in 45 pairs.

The rostral, which just reaches the upper surface of the head, does not occupy much more than half the anterior margin of the upper jaw. The single anterior frontal is nearly as long as broad, and is a little smaller than each of the posterior frontals; vertical fully twice as long as broad, elongately subpentagonal; occipitals a little longer than the vertical. Loreal trapezoidal, on one side the loreal is partly united to the postfrontal; one præ-, two post-oculars. Temporals 1 + 2. Upper labials 8, gradually increasing in size to the 7th; the eighth is small and no larger than the adjoining scales, the 4th enters the orbit. Only one pair of large chin-shields, the posterior pair scarcely exceed the adjoining scales in size.

Colour blackish ashy with a row of large irregular-shaped black spots down the back and another rather less in size, but each spot including several scales, down each side; a blackish band down the margins of the ventrals caused by the dark edges of the shields and of the first row of scales on each side.

The specimen is 12 inches long, of which the tail measures 1½. It was collected by Dr. Baker in Pogn, I believe, in the neighbourhood of Bassein, and sent to me with some other snakes for examination by Captain Spearman.

This *Hypsirhina* appears separable from all other species by the larger number of rows of scales. The scales in this genus are so regular, that I think even a single specimen affords sufficient evidence of distinction, and the Pegu snake is further distinguished from *H. chinensis*, its nearest ally, by having a smaller number of ventral shields. In *H. chinensis* there are 28 rows of scales round the body and 150 ventrals. I have not access to a specimen of *H. chinensis*, and so far as I am aware no figure of this species has been published, so I cannot tell whether *H. maculata* has a differently formed head. From the two species of *Hypsirhina* previously recorded from Burma and India, *H. plumbea* and *H. enhydria*, the present form is at once distinguished by its much blunter muzzle and smaller præfrontal shield, and by its coloration, besides the much more numerous rows of scales.

DIPSAS TRIANGULATA.

A young snake, obtained by Major Mockler at Gwádar in Baluchistán, appears to me to be nearer to this species than to any other, although I cannot feel sure that it is correctly identified, for, although I can detect no distinction in the shields, the head appears narrower, less triangular, and peculiarly coloured, and the muzzle broader than in other examples of the species. The locality is of interest also, as it is much farther west than this snake has been previously found, Gwádar being about 200 miles west of the British frontier, and the occurrence on the Baluchistán coast shews how thoroughly terrestrial a form this species of *Dipsas* is, for there is not a single tree and scarcely a bush to be found near Gwádar, which is merely a fishing village on a barren spit of sand, between a rocky promontory and the mainland.

The length of the specimen is 12 inches, of which the tail is 2½. Ventrals 280, subcaudals 92. The upper surface and side of the head are mottled with black, which prevails in front, so that the frontals, rostral, and anterior labials are entirely black or blackish. On the body there are the usual rather irregular transverse dark-edged whitish elongated spots.

XENURELAPS BUNGABOIDES.

This snake has hitherto only been reported from the Khási hills, where it appears to be rare.* In 1878, I captured a specimen close to Dar-

* Günther, Rept. Brit. Ind. p. 345; Jerdon, P. A. S. B., 1870, p. 82.

filings, and, subsequently, Dr Anderson obtained another from the Government Cinchona Plantation in Sikkim.

The specimen taken by myself is much larger than the type, and measures 82 inches in length, of which the tail is 4. It was caught in the dusk of evening on the road round Birch-hill, at an elevation of rather less than 7000 feet above the sea. When taken it appeared sluggish and made no attempt to bite.

HYDROPHIS LAPEMOIDES.

A specimen, sent from Gwádar in Baluchistán by Major Mockler and collected, doubtless, on the Makrán coast, agrees so well with Dr Gunther's description of *H. lapemoides* that I have no doubt it must be assigned to that species. The dorsal scales, in the posterior part of the body especially, have a short tubercular keel, but on the lateral scales there is only a central tubercle. Thirty-five black rings round the trunk, the anterior rings imperfect below. Length $15\frac{1}{2}$ inches, of which the tail measures 1·6 and the cleft of the mouth 0·4.

HYDROPHIS LATIFASCIATA.

A specimen, agreeing very fairly with the description of this species (of which the type was procured from Mergui), has been sent to me by Captain Spearman from Pegu. There are, however, one or two characters which seem to shew a tendency to a passage into *H. coronata*. The lateral scales on the hinder stout portion of the body have a slightly elongated tubercle rather than a keel, and the ventrals bear two such tubercles. Even on the dorsal scales, the keel does not extend half the length of the scale. The coloration agrees with the description of that found in *H. latifasciata* so far, that the yellow rings are very imperfect and the blackish colour covers a much larger portion of the body, the whole of the lower part of the anterior two-thirds being black and the yellow rings being only faintly traceable across the band throughout the thicker part of the trunk, they extend in general across the neck, though narrower on the upper surface, and appear in the anterior part of the body as well-defined transverse spots, but on the thicker portion and tail they are only conspicuous as elongated oval spots with indistinct edges along the sides. There are 56 of these imperfect yellow rings on the neck and body, 9 on the tail. Length 27 inches, neck about one-third of the whole, cleft of mouth 0·3 inch, tail $3\frac{1}{2}$.

have seen native women screw their hands into bangles barely over two inches in inside diameter. Those with the perforation only $1\frac{1}{2}$ in. in diameter were probably in the course of manufacture. The peculiar conical nature of the orifice on both sides in these specimens is due to the necessarily rotary motion imparted to the borer by the hand and arm. These holes were usually begun on both sides, for the reason that they would be easier to enlarge when so made.

~~~~~

XVII.—*The Ravages of Rats and Mice in the Dakhan during the Harvest of 1878-79* —By the REV. S. B. FAIRBANK, D. D.

Some years ago, when itinerating in the vicinity of the Perá River, near Ahmednagar, I was astonished at the stories told me about the destruction of whole fields of *Jawáí* (*Holcus sorghum*) by rats. I went to the fields, and, though it was after the harvest so that I could not see the progress of devastation, I found the ground thickly dotted with small holes, and marked in all directions by the paths the rats had made, principally in passing from one hole to another. I tried to get specimens of the rats, but failed, as I was then unacquainted with their habits, or perhaps they had gone elsewhere, as the people claimed they had. They must have been the *Mettáq* rats (*Golunda mettada*) of whose ravages Sir Walter Elliot wrote fifty-three years ago.

Since I saw those fields I have sometimes heard of injury done to crops by rats, but of nothing very extensive, till their ravages that began at the end of 1878, when the *Babí* (winter) crops began to ripen, attracted the attention of everybody. There had been destruction before, but when, daily, large quantities of green Sorghum stalks were brought to Nagar for sale, and it was known that they had the night before been cut down by rats, everybody wakened up to the importance of the subject. At first stalks were cut down here and there in the fields, but more were cut as the days went on. And afterwards fields were suddenly attacked and destroyed in a few nights. When food became scarce where they were, the rats gathered their forces and an army of them invaded fields that had not been harmed before and quickly destroyed them. In some places they did not cut down the stalks, but climbed them and gnawed off the ears of grain. Some of the ears thus cut off were eaten or partially eaten where they fell, and some were hauled into their holes by the rats and stored there. A good deal of the grain thus stored was dug up and used for food. The farmers, finding that the rats would not allow their grain to ripen, gathered as many as they could

of the unripe ears, and, although the grain was still in the milk stage of its development, when dried it was fit for food. They thus saved an eighth or a sixteenth of the crop they had expected to harvest. The rats also attacked the growing wheat and much of that was harvested while the grain was in the milk, but the dried unripe grain was shrivelled, small in quantity and poor in quality. Gardens of egg-plants and other irrigated vegetables were found by the rats and the fruit was eaten by them while it was still immature. Even carrots were eaten, and so was lucerne in the hot season, when their supply of *haraydl* grass (*Cynodon dactylon*), which is their usual food, was exhausted. The patches of melons and other *cucurbitaceæ* that are grown in the moist sand of river beds during the hot season, were nightly visited by the rats, and each melon was eaten before it was ripe enough for the use of man.

These ravages extended over several thousand square miles. The Parner, Shrigonde and Karzat tálúks and part of the Nagar tálúk in the Ahmednagar Collectorate, the Indápúr tálúk of the Púna Collectorate, all the Sholápúr Collectorate and the northern third of the Kaladgi Collectorate, as well as the adjoining Native States, were ravaged, though the crops were not so much injured along the N. E. and S. W. borders of this belt as they were in the middle of it. How far the plague extended to the E and S. E. of the region specified above I have not been able to learn. Groups of villages in other parts of the Ahmednagar Collectorate, especially to the N E of Nagar, suffered in the same way. The region particularly specified extends from N. W. to S. E. for about 175 miles, and is from 40 to 80 miles wide. I travelled through a large part of it in May and June, and found that most of the villagers had already consumed what the rats had left, and in whole groups of villages there was no grain that could be purchased which had been raised there. All that I could find was imported grain and was mostly the flat kind of Sorghum that is brought from Jabalpúr. The people had been living, for weeks, mostly on wild seeds and sweet potatoes (using the leaves as well as the roots) which had been raised by irrigation. Near Sholápúr there was some *bijari* (*Holcus spicatus*) left of the *kharij* (autumn) crop of 1878, which was for sale; and *náchani* (*Eleusine coracana*), to the use of which the people were unaccustomed, was also brought from the Madras side and exposed for sale. The wild seeds of *Indigofera linifolia*, *I. cordifolia* and *I. glandulosa* were also sold, the price being about two-thirds the price of Sorghum millet. The seeds of some malvaceous weeds, such as *Abutilon indicum* and *Hibiscus* sp. ?, were also used for food, but I found none exposed for sale. I looked in the fields for specimens of the *Tradescantias* and *Commelinas*, the seeds of which were prized so highly in the famine of 1877, but could find none. It would seem that they had been nearly extirpated.

The people attribute these ravages to the Jerboa rat (*Gerbillus indicus* or *G. cuvieri*) which they usually call the *pánghará undir*, that is, the *white rat*. The white belly of the *Gerbille* is often distinctly seen when it is jumping about in the dusk of evening. They say there are also *Kálé undir*, that is *black rats*, among the robbers, but that they are comparatively few. These are the *Kok* or mole-rats (*Nesokia indica*) which are not black but only dark and much of the size and colour of the brown house-rat (*Mus decumanus*), though they are at once distinguished by their broad bluff muzzle, and are much heavier. The people suppose that the *Mettáds*, which are of still another group and are for their size more destructive than either of the above, are the young of the others. Jerdon calls the *Mettád* (*Golunda mettada*) "the soft-furred field-rat." Most would rather call it the large-eared field-mouse. These three species include most of "the horrid rats" which have increased so astonishingly, and thus have been able to ravage so large a region. In some places the house-rats and mice, and other field rats and spiny mice helped to devour the crop.

I wrote of these matters briefly to Mr. W. T. Blanford, who is our authority on matters pertaining to the Mammalia, and I give an extract from his answer, as follows:—"By one of the last mails I had a letter from Sir Walter Elliot (who, you may remember, was the first to collect the rats and mice of the Dekhan and to notice the injury committed by them,) referring to the plague these animals had been, and suggesting that *Mus mettada* was again the depredator. It is new to me to hear of *Gerbillus indicus* (or rather the Southern *G. cuvieri*) as a serious nuisance." But though I think the *Mettád* should have the credit of learning to climb the Sorghum stalks and to cut off the ears of grain, there is no doubt that the *Gerbilles* have been the most numerous and so the most destructive this year. They have been taken in the act everywhere. And for the sake of the crops to come, it is particularly a matter of regret that they seem to thrive just as well during the rains as in the other parts of the year. The *Mettád* lives mostly in the cracks and the small burrows it makes in the black soil, and the *Kok* burrows in the black soil. Where the first rains that fell were heavy, the black soil suddenly swelling, so as to fill up any holes or cracks there had been in it, caught the *Mettád* and *Kok* rats as securely as traps would have caught them and smothered the greater part of them. T. Davidson, Esq., writing me from Mádhá, of the Sholápur Collectorate, on the 20th May, tells how it was there. "There was a grand slaughter of rats on Monday night and Tuesday morning. It rained 2.65 inches, and in the morning the whole black soil was covered with dead and dying rats, sticking in the mud. The people say half have died."

But the Jerboa rat makes his burrow in the light soil, in stony places,

or, if in the black soil, among bushes where the soil does not bake and crack so much, and he burrows so that his sitting-room is near the surface, though approached by passages that are deeper, and he can easily work through the roof of it if water troubles him. The *Gerbilles* about here do not seem any less numerous than they did before the rains began. At any rate they are still excessively abundant.

The people use no means for destroying these rats. They seem superstitiously afraid of still more vexing the angry divinity. So they say "The rats were sent, and if we kill them, more will come." Or, thinking that those who died in the famine have now been born as rats, they say, "We did not feed them when they were starving, and now they have come back to eat us out."

The black-winged Kite (*Elanus caeruleus*), feeds on these rats, and is now, for the first time in my experience of thirty-three years, abundant in this part of the Dakhan. In former years I saw one or two in the course of the cold season. But this year I have seen them by dozens in a day and they are still here (in July,) and to be found all the way from Ahmednagar to Bijápúr.



XVIII.—*Notes on the Survey Operations in Afghanistan in connection with the Campaign of 1878-79. Compiled from Letters and Diaries of the Survey officers by MAJOR J. WATERHOUSE, Assistant Surveyor General.—Communicated by MAJOR-GENERAL J. T. WALKER, R. E., C. B., Surveyor General of India.*

(With Map—Plate XVII.)

The Campaign in Afghanistan has added considerably to our geographical and topographical knowledge of that country, thanks to the zeal with which the Survey operations were pushed on by the Surveyor General's and Quarter-Master General's Departments, aided by the Political and Military authorities. No less than 18 officers of the Survey of India were employed with the three columns—7 with the Quetta Column, 2 with the Kuram Valley Column and 4 with the Peshawar Column.

The operations of the professional survey were also, with the Quetta and Kuram Valley Columns, supplemented by the work of regimental and staff officers who in some cases were appointed Asst. Field Engineers to aid in the Survey, and in others worked independently under the military authorities.



## I. QUETTA COLUMN.

A large number of Surveyors being with the Quetta Column, a good deal of quite new country was explored and old reconnaissances checked and improved. The survey operations were, however, almost always in immediate connection with the military movements, and although every possible assistance and facility was freely given by the authorities, the work of the Surveyors had to be confined to a few miles on either side of the routes followed by the troops, and to fixing points from such mountain peaks as they had the opportunity of ascending.

Necessarily many of these routes were the same as had been surveyed in 1839-42, but, thanks to the advanced state of the operations of the Great Trigonometrical Survey of India, they can now be more accurately connected with the Geography of India, the connecting link being the preliminary triangulation carried on by Capt. Rogers, R. N., in the early part of 1878 and consisting, as stated in the *General Report of the Operations of the Survey of India for 1877-78*, p. 15, of an extension of the Indus Series by a secondary triangulation from the western Frontier of Sind into Baluchistán, along the line between Jacobabad and Quetta, and of a small triangulation in the Quetta Valley for the purpose of fixing the position and heights of the most conspicuous hills around, and connecting them with permanent marks which were put down for reference near the cantonments.

The survey operations with this column have consequently been based upon this triangulation. The fixed peaks on the Sulimani Range have been and will be very serviceable for the lines of survey from West to East across the great belt of hitherto *terra incognita*, between the road to Kandahár and the British Frontier.

Capt M. W. Rogers, R. N. was attached to the advanced Force under General Stewart and carried on a route Survey from Quetta to Kila Abdulla at the foot of the Kwája Amrán Range, and thence to the crest of the Khojak Pass on the same range. He says this range was a great obstacle to the survey, extending right across the route and presenting no peaks for identification on the other side. It runs North and East, bearing  $210^{\circ}$  or thereabouts. There are in it three known passes, Khojak, Boghani and Gwája. The Khojak, the most northerly, starts from Kila Abdulla and was the one used by the army in 1839. It is about  $10\frac{1}{2}$  miles to the crest or *Ketai*, which is about 7,600 feet above sea level. The first 10 miles are not difficult, but the next  $1\frac{1}{2}$  are very steep, narrow and winding, and no work had been able to make it more than a practicable but difficult road. From the crest there is a very steep descent; a zig-zag camel track had been made and a straight (or nearly so) glide for guns (angle  $80^{\circ}$ ); over this the field guns were lowered, but it would be almost impossi-

ble to bring them up again. To Chaman, on the Kandāhār side from the crest, after the  $\frac{1}{2}$  mile of steep descent, there is a gentle slope of  $4\frac{1}{2}$  miles.

The country on the other side of the Khojak he describes as a plain with small hills and ranges rising from it. Towards the south-west it is a sandy desert to all appearances with no hills.

From a hill of 8,200 feet near the Khojak he observed two of his old stations Takatu and Chiltan and all recognisable peaks around, especially in front.

He then went with General Stewart to Gulistán Karez, at the foot of the Gwāja pass, and traversed through the pass. He says this pass is but little known, but has always been the Kaśila route. Colonel Sankey had improved it and made it a very good road, about 22 miles long with fairly easy gradients; its crest is some 700 feet lower than that of the Khojak, and native report, which says that the latter is closed every year after the first fall of snow, says that the Gwāja has not been closed for 10 years. Captain Rogers visited what he believed to be the highest peak of the range, about 9,100 feet, and had a splendid view. He could see Quetta and some hills which the natives said were close to Kandahār. He carried on his traverse through the Gwāja Pass *vid* Haoz and Jaktipal to Kandahār, the points he had fixed from the Kwāja range aiding him greatly. He says the country between the Kwāja Amrán Range and Kandahār is full of hills and ravines, flat generally and very fertile in many places.

In December, 1878, a route survey with chain and plane-table was made by Captain R. Beavan of the Survey of India, starting from Madadalari G. T. S., near the Bhandawali Post, *vid* Bugti Dera up to the point where the road emerges into the Katchi near Lehri.

At the request of General Stewart he then explored the routes on either side of the Bolán Pass with the object of finding an alternative route, and states that there is a fair track for camels from Naghesur by the Pashtal Valley to Kirta, up which a road might be made for carts at some expense, but no labour is obtainable in that part of the country.

There is also a route by the Mushkaf River from Sibi, or entering the hills by the Kumri stream near Dadur, over Takri Takht and down the Pishi stream into the Kirta (Laleji) Valley opposite Bibināni. This, however, crosses the range of hills which rise 400 or 500 feet above the plain on either side, and without tunneling it would be very difficult to make a road for carts.

The whole of the country is very stony, nothing underfoot but boulders and gravel with a small proportion of sandy soil. The hills are mostly in parallel ridges with stony plains intervening.

Captain Beavan then carried a route traverse up the Bolán Pass from

Dádur, closing on the bungalow at Darwáza. He was obliged to leave off at this point owing to want of water and absence of food for the camels. He commenced again from Quetta and carried on a traverse through the Gwájá Pass towards Kandahár, by the same route as Captain Rogers, in rear of the advanced force under General Stewart, continuing it on to Gírishk and thence back to Kandahár by another route through Yikohal, Kak-i-chopan, Khushki Nakhud, Atah Karez, Hadi Madat and Sangzuri.

This route survey from Quetta to Gírishk has all been plotted on the scale of 1 inch to a mile, with as much detail on either side as could be managed, and a reduced map on the scale of  $\frac{1}{4}$  inch to a mile has also been completed.

A survey of the route from Chaman, at the foot of the western side of the Khojak Pass, to Kandahár, *vid* Gatai, Mel Manda, Abdul Rahman ka Kila and Mand Hissar, in all 77 $\frac{1}{2}$  miles, was made by Lieut. J Hobday, s. o.

From Quetta, Lieut Gore, r. e. was engaged about the beginning of March in making a survey of the Pishin Valley on the scale of 2 miles to an inch, assisted by Captain Maitland of the 3rd Sind Horse, Assistant Field Engineer. This survey is based on an independent base near Gulistán Karez and connected with Captain Rogers' triangulation in the neighbourhood of Quetta.

Lieut. Gore describes the Pishin Valley as practically dead flat and upwards of 25 to 30 miles wide. He had some difficulty in obtaining suitable points, as there is a singular want of well-defined and recognisable peaks on the borders of the valley itself. On the eastern side of the valley along the foot of the Ajiram range the ground is greatly broken and cut up, water is scarce and the country is inhabited by nomad Kakars.

In conjunction with Captains Heaviside and Holdich, Lieut. Gore fixed points across the northern end of the valley, in order to connect his work in Pishin with the survey of the Thal Chotiali Route made by the latter officers.

Early in April, Major W. M. Campbell, r. e. went from Quetta with a detachment to Shoráwak and made a route traverse with compass and perambulator of about 157 miles through Ispintáza, Hisábat, Bádalzái, Zabardasht, Shoráwak Karez, Itáz Karez, Issurkai, Ispinkai, Chichizai, Showd, Panchpai, Shorad, Khanak, Barg and back to Quetta. This traverse, though rather rough, is valuable as being almost all through nearly unknown country, and it helps to mark some very important features, for instance, the edge of the great desert, the course of the Lora, the Khán's boundary &c. It gives the position of several ranges of hills and a fair idea of their nature and direction for some miles on either side.

Major Campbell was also able to make observations for latitude and longitude at several points and to connect his traverse by triangulation with reference to one of Captain Rogers' points, Chiltán, a high peak near Quetta and visible at great distances.

On his return to Quetta Major Campbell arranged with Capt. Rogers for determining by telegraph the difference of longitude between that place and Kandahár.

Shortly after the arrival of the army at Kandahár Captain Rogers accompanied the expedition to Khelát-i-Ghilzái and on the march carried on his traverse continuously, fixing as far as possible the positions and general features on each side of the Tarnak River. The Force marched up the right bank keeping near the river; the hills on both sides, Captain Rogers says, are pretty continuous, smaller and more broken up on the left bank and approaching more nearly to the stream. On the right bank the hills are more continuous and are from 6 to 10 miles from the stream; a succession of high rolling mounds interpose between them and the river, sometimes receding and allowing a small strip of fertile country to interpose and sometimes coming right down to the river bank.

The road winds along the foot of these mounds and a good view of the hills is difficult.

He was not able to say if this undulating country extended up to the hills; but, judging from the country near Khelát, which he explored more thoroughly, he would say it did not, but that between it and the real hills there were valleys and villages.

At Khelát-i-Ghilzái Captain Rogers fixed points to help in the survey of the country around. Colonel Sankey, Chief Engineer, employed some of his officers on a large-scale survey round the Fort, and Lieut. Ollivier, R. E. and Captain Sartorius of H. M.'s 59th Regt were told off to work in connection with Captain Rogers further out. Owing to military reasons Captain Rogers was not able to go far, and did not cross the river to any distance until a few days before the Force left, when he got on a high hill south of Khelát and had a view towards the Arghasán Valley, which does not seem to be at all the chaos of indiscriminate hills entered on the maps; in fact in one direction he could see an opening of considerable width down which he could not detect a single hill with a telescope. Thanks to the exertions of Captain Chapman, Assistant Quarter-Master General, they were able to considerably improve the geography of the country. Supplied with points by Captain Rogers, Captain Sartorius made a topographical sketch of the country around Khelát and towards Ghazni. A small force went down the Arghasán Valley with directions to survey as much as possible. This expedition did not, however, bring in much as it degenerated into a simple route survey without any information 200 yards from the line.

Captain Rogers got leave to go down the Arghandáb Valley with a small force. He had with him Lieut. Ollivier, R. E., and did a fair amount of survey, about 400 square miles up to Kandahár. He describes the country as one vast conglomeration of hills and mountains very difficult to work in. The Arghandáb River is a large rapid mountain stream running in many cases between perpendicular cliffs; it is impossible to follow its course for more than a few miles at a time, it has numerous side streams along which are strips of fertile ground and villages. The halts are at these and the marches are generally up or down these side valleys and then over the intervening ridge into the next valley. Nearer Kandahár the hills are less continuous and the ground more open. The Survey party got on fairly well with the people, who brought in supplies and got well paid for them, but was unable to move without a strong escort as the people were not to be trusted. Captain Rogers says that so far as he has gone the distances and the positions of places such as Kandahár and Khelát are very fairly accurate, but the hills and general ideas of the country are faulty and require correction. For instance the part round Khelát-i-Ghilzái is entirely wrong. The Arghasán and Arghandáb Valleys are almost a blank. On the whole he thinks the Arghandáb Survey will be a good addition to the knowledge of the country. The route survey he made from Quetta to Khelát-i-Ghilzái is seemingly a repetition but, possibly, an improvement.

After the return of the expedition to Kandahár from Khelát-i-Ghilzái, Captains Heaviside and Rogers, R. E. were employed along with other officers of the Survey in making a survey of the country 12 miles round Kandahár on the scale of 1 inch to the mile, and several officers from different corps were appointed Assistant Field Engineers to take up the detail survey with plane-table.

Captain Heaviside has given an interesting account of Kandahár: he says it lies in a valley about 35 miles long, east and west, by 7 miles broad. The country to the east is a flat stony plain; to the west and south-west an area of some 40 square miles is thickly populated with numerous villages and a net-work of mud walls, orchards, and irrigation channels with but few roads, and what there are, narrow, tortuous, and more or less flooded by field irrigation channels.

Of the hills those to the north and north-east, distant 5 or 6 miles, are lofty and precipitous, completely shutting out the country beyond; those to the east though lofty are far distant. To the south-east there is a low short range, distant about 8 miles, over which glimpses of the country towards the Khojak Pass are obtained. To the south and south-west the country is open and the desert is seen as an elevated plateau. On the west there are sharp-peaked narrow ranges a good deal broken up, distant 4 or 5 miles, which become even more isolated and broken to the north-

west, and it is here that there are passes into the Arghandáb Valley whence the water is brought in which irrigates the Kandahár Valley. The water of the Tarnak is not, so far as he had seen, used for irrigation as it runs at too low a level. The city is built for the most part of mud and of sun-dried bricks, so little masonry is there about it; but it is built solidly, with walls 4 or 5 feet thick, on a large scale, and in the dry climate the weather does not very seriously affect even mud.

The high massive walls of the city appear in excellent order from outside, and it is only when one comes inside and stands on the tower of the citadel that the dilapidations become striking, and one comes to the conclusion that, with the exception of one or two mosques and a mausoleum, Kandahár is at least very much out of repair. The citadel is a palace with all the accessories of court-yards and stables on a large scale, surrounded by a high massive wall and ramparts of its own. The buildings in the citadel in many cases are of three and four storeys: the walls very thick, the rooms low and small, connected by numerous dark low passages with curious deep recesses, probably for servants; most of the buildings have well-lighted underground rooms—prophetic of great heat.

The bazar contains many good things of a certain class, and is crowded all day. The inhabitants treated the troops outwardly as if they were used to them, neither glad to see them, nor displeased at their being there, and they were at least ready to sell them anything.

There are excellent cheap sheepskin coats and stockings, *chogas* of *paashmina* and of capital close felt, which appears to be a Kandahár *specialité*: old British uniforms of all kinds, but very little English cloth, Manchester or other. The copper-work in pots and pans, the iron agricultural implements, the earthen-ware drinking and eating vessels all exhibit more finish and more artistic feeling than those of the Hindus. The leather too is much better prepared than in India, though there is still the same weak sewing.

But the feature as compared with the bazars of Hindustán is the variety and quantity of the food exposed for sale: fried fish and *kabobs*, stewed fruit and curds; the Kandahár bread, an excellent light flat cake; carrots, spinach and watercresses; while the stalls for the sale of raisins, almonds, dried figs, apricots and such pomegranates as Captain Heaviside had never seen before, were as common as public-houses in London.

In April, a party of surveyors, consisting of Captain Rogers and Lieut. Hobday with Captain Sartorius, 59th Regt. and Lieut. Baynes, 80th Regt. Asst. Field Engineers, accompanied a column going for revenue into the country north of Kandahár between the Arghandáb River and the hills of the north side of the Khakrez Valley, and the survey of this and adjacent valleys was carried out as the movements of the troops allowed, the northernmost limit being Asub Kila, or Gandáb, about 36 miles from Kandahár.

About 500 square miles were plane-tabled by Lieut. Hobday and Captain Sartorius on the  $\frac{1}{2}$  inch scale; a route survey carried on on the 1-inch scale by Lieut. Baynes, and a number of points fixed trigonometrically.

Lieut. Hobday says, that they found the people in the Khakras Valley quiet and amenable enough. There was a fair sprinkling of villages and cultivation, and water plentiful. They came across a fair-sized plateau at an elevation of about 7,000 feet, with wild rhubarb, onions, and water-cresses in abundance. The elevation of the valley is much higher than that of Kandahár, and they consequently found it much cooler and got away from the flies. They also came across lead, iron, copper and crys-talite.

At Girishk, Captain Beavan made a large-scale survey and completed a map of the position at Girishk and passage of the Helmand on the scale of 4 inches to the mile, including about 20 square miles of the Helmand Valley with the Fort and military position. He also determined the position of numerous hill peaks.

After his return to Kandahár he completed a survey of the new cantonment on the scale of 16 inches to the mile, and at the end of April was engaged in carrying on a general survey of the cultivated land adjoining the city of Kandahár on the scale of 4 inches to the mile.

When it was determined early in February to withdraw a part of the Force by the Thal Chotálí route under the command of General Biddulph, Captains Heaviside and Holdich, R. E., were appointed to accompany the Force as Surveyors, Captain Heaviside taking charge of the triangulation, and Captain Holdich of the topography.

Before starting, Captain Heaviside proceeded to the Kadanai Valley, where he measured a base line and carried a triangulation across the valley to the Hadah Hills and thence fixed several points to the North, East and West.

Captain Heaviside remarks that the name Ghanti given to the range between the Khojak Pass and Kandahár should be erased. The name is unknown and has probably been confused with the Ghetai Hills. It is very difficult to obtain correct names in Afghanistan, but from the Kadanai Valley the highest hill of the range is called Hadah; it rises 2,500 feet above the valley and scarcely deserves the name of a mountain in this part of the country.

Captain Holdich joined Captain Heaviside in the Kadanai Valley on the 20th February, and notwithstanding the thickness of the atmosphere and inclemency of the weather was able to sketch in on the plane-table a fair portion of the valley. These two officers re-crossed the Khojak on the 6th of March by a capital road with easy gradients which had been recently

made, and Captain Heaviside was able to connect his Kadanai work with the Khojak points, but only by staying on the top for several hours waiting for breaks in the alternations of dust and showers below and snow above. From these points he carried a connection by triangulation across the Pishin Valley to Khushdil, but with great difficulty owing to the heaviness of the weather. Captain Houldich at the same time carried on his plane-tableing on the basis of two or three points fixed by Captain Rogers near Quetta, also on points obtained from independent bases, and occasionally from the traverse work with compass and perambulator, which was continued steadily through from camp to camp. From Balozai, two marches beyond Khushdil, he made a reconnaissance southwards with Col. Brown, R. E., to Gwal and Amadún, while Captain Heaviside accompanied General Biddulph on a reconnaissance to the head of the Zhob Valley.

Leaving Balozai on the 24th of March, the Thal Chotiáli Force marched nearly due east through Eusaf Katch to Spirargah. The route led chiefly up the bed of a main tributary of the Surkháb river over the Ushtaráh Pass 8,000 feet high. The scenery about this pass was quite Alpine in character: the camp was pitched at the foot of a fine snow mountain, the hill sides were fairly clothed with a species of juniper, while the extraordinarily varied and brilliant colouring of the soil lent additional charm to the scene and was a pleasant change from the monotony of flat treeless valleys and bare rocky hills that characterised the country between Kandahár and Quetta. From Spirargah the Force marched over the Momangai Pass (8,500 feet) to Obo-kui, Chimján and Ningán where the Bori Valley was struck. From Ningán, the line taken lay north of the route through Thal and Chotiáli pursued by the 1st and 3rd columns, and the Bori Valley was followed and for a distance of 80 miles was found to be wide and open, well cultivated and more prosperous looking than anything they had seen since leaving Kandahár. This valley was quitted three marches beyond Ningán where the Anambár river passes through a gap in the range bounding the valley to the south. The Khru mountain which overhangs this gap was ascended in the hope that some points on the Sulimán range would be seen therefrom, but this expectation was disappointed. A connected triangulation had been carried on to this point, but triangulation had now to be dropped and the Survey carried on solely with the plane table, checked by traverses and Astronomical latitudes. Leaving the Anambár gap (8,800 feet) the Force, instead of following the Anambár river southwards to Chotiáli, marched to the south-east, crossing the Tikh Kurram Pass (4,200 feet) and thence into the Chamálang Valley in two long marches. From Chamálang the route led due south over the Hanukai Pass (4,400 feet) to Balladaka, and thence over the Han Pass to the Kaho Valley. Between Anambár and the Kaho Valley the country is



rugged and the valleys even uninhabited owing to disputes amongst the neighbouring tribes. *Lugári Barkhán* (8,500 feet) in the *Kaho Valley*, about 10 miles above *Vitákri*, was reached on the 8th of April, after a march of 190 miles in 16 days.

Captain Holdich sums up the results as 5000 square miles of  $\frac{1}{4}$  inch mapping, 270 linear miles of traverse on the 1 inch scale, and several plans of sites &c. The mapping includes the heads of the *Pishin* and *Kadanai* Valleys and a good margin beyond the country actually mapped, of which the geography can be very closely conjectured, so that the south-east corner of *Afghánistán* may be said to be known. Captain Holdich also says that there is a more northerly route which he would have liked to have explored; the real high road, as he believes, to *Kandahár*, and even better and straighter than the *Thal Chotiáli* route, good as that was found. This route leads *viâ* the *Zhob Valley* and the *Karwaddi Pass*, of which at present only native information is available. A railway could be run without difficulty along the route followed by the Survey.

After the *Thal Chotiáli* Force returned to India, Captains *Heaviside* and *Holdich* remained a month at *Fort Munro* on the *Sulimán Range* and were enabled while there to connect two *Trigonometrical* points on the range with several points to the west along the route they had come by, thus leaving a gap in the triangulation of less than 80 miles.

On the 10th May Major *Campbell* and *Lieut. Gore* accompanied Captain *Wylie*, the Political Officer, from *Alizai* on a reconnaissance to the *Toba Plateau* on the north of the *Pishin Valley*. The first camp, *Arsala ka Masjid*,  $10\frac{1}{2}$  miles from *Alizai*, is in a *nala* about half way up the pass; 9 miles further, on the top edge of the plateau, at an elevation of 8,000 feet, they camped at *Mandan*, which is the name of the district and stream, though there is no village. Two marches further on they reached *Haji Khán ka Kila*, the extreme north-east point of their route. The country passed through is at first undulating, running into hilly towards the north. Major *Campbell* remarks that the name of what is called "*Toba Peak*" on the map is '*Kand.*' The expedition marched back through *Kakar Toba* into *Achakzai Toba*, going *viâ* *Sábur*, *Drajandar*, *Kurak*, *Gwal* (one of Captain *Holdich's* points) and *Ghan Oba*, where they left the hilly ground and entered the open plain country called '*Tobin*,' which lies west of *Toba* and borders the *Kadanai Valley*. It is the more extensive plateau of the two, but water is scarce. Hence they went to *Sina* across the plain over the ridge of the *Khojak Hills* (north of *Pass*) and down the *Bogra Pass* into the plain of *Kadanai*. *Lieut. Gore* says the upper part of the *Bogra Pass* into *Kadanai* is very steep and bad for camels for about  $\frac{1}{4}$  mile, after that it is a good road.

The expedition was to go a short way up the Kadanai Valley, then up another road into Tobin, returning to Pishin by the Arambi Valley, quite a different route to that they went by.

The results of the Survey with this Column up to the end of May may therefore be summed up as follows :

Route Surveys from the Bhundowali Post to near Lehri, and from Dadur to Girishk.

Survey of the Bolan Pass and neighbourhood.

Survey round Quetta.

Survey of the Pishin Valley and reconnaissance of the Shorawak valley.

Reconnaissance of the Arghandáb and Arghasán Valleys from Kanda-hár to Khelát-i-Ghilzái.

Survey round Khelát-i-Ghilzái.

Surveys round Kandahár.

Survey round Girishk.

Survey of the Khakrez Valley.

Reconnaissance of the Kadanai Valley and survey of the Thal Chotiáli Route.

Reconnaissance of the Toba plateau and neighbouring country.

Captain Heaviside has given the approximate latitudes, longitudes and heights of the following places on the Thal Chotiáli Route, based on Captain Rogers' values, *viz.* :—

|                                  | Lat.        | Long.      |
|----------------------------------|-------------|------------|
| Takatú, east peak highest, ..... | 30° 24' 13" | 67° 6' 15" |
| Ohltan, southern peak, .....     | 30° 1' 11"  | 66 48 42   |
| Khojak, east point, .....        | 30 51 33    | 66 33 54   |
| Kwája Amrán, .....               | 30 39 30    | 66 24 45   |
| Height of Quetta 5,500 ft.       |             |            |

The heights are aneroidal, and the passes are probably made a little too high.

|                                                                       | Lat.    | Long.  | Height 5,100 ft. |
|-----------------------------------------------------------------------|---------|--------|------------------|
| <b>Major-General Bullard's Route.</b> Khushdil (Pishin Valley), ..... | 30° 42' | 67° 5' | 7,000 "          |
| Suranari Pass, .....                                                  |         |        | 6,800 "          |
| Balozai, .....                                                        | 30 38   | 67 18  | 7,100 "          |
| Metrasai Pass, .....                                                  | 30 45   | 67 30  | 8,000 "          |
| Uaktaráh Pass, .....                                                  | 30 36   | 67 32  | 8,500 "          |
| Momangai Pass, .....                                                  | 30 34   | 67 42  | 7,200 "          |
| Chimján, .....                                                        | 30 34   | 67 57  | 5,850 "          |
| Ningán (Bori Valley), .....                                           | 30 27   | 68 23  | 3,900 "          |
| Anambár Gap, .....                                                    | 30 21   | 69 2   | 3,900 "          |
| Chamáláng Valley, .....                                               | 30 9    | 69 23  | 4,400 "          |
| Hanukai Pass, .....                                                   |         |        | 4,800 "          |
| Han Pass, .....                                                       |         |        | 4,400 "          |
| Nahar Kot (Lugári Barkhán),                                           | 29 46   | 69 27  | 2,500 "          |

|                                                |                         |         |         |                  |
|------------------------------------------------|-------------------------|---------|---------|------------------|
| Major Sandeman and<br>General Nuttall's Route. | Chimján as above, ..... | 30° 16' | 68° 17' |                  |
|                                                | Smalan, .....           |         |         |                  |
|                                                | Sagawe, .....           | 30 17   | 68 20   | Height 5,500 ft. |
|                                                | Baghao, .....           | 30 16   | 68 29   | 4,800 „          |
|                                                | Rohi, .....             | 30 9    | 68 35   | 3,900 „          |
|                                                | Tal, .....              | 30 1    | 68 48   | 3,200 „          |
|                                                | Chotiáli, .....         | 30 2    | 68 54   | 3,300 „          |
|                                                | Baramzai, .....         | 29 59   | 69 14   | 3,750 „          |
|                                                | Nahar Kot, as above.    |         |         |                  |

Balozai and Metrazai are in the Surkháb; the latter place being on the watershed at the head of the Surkháb and Zhob Valleys.

Since the above values were determined, Mr. W. C. Price has carried a triangulation from the Indus Valley Series across the Sind desert and up to Quetta. This connexion will enable the fair maps of Southern Afghánistán to be compiled on a base as rigorously accurate as other portions of the Survey of India.

## II. KURAM VALLEY COLUMN.

The Kuram Valley Force, under Major-General Roberts, C. B., V. C., being smaller than the others, the Survey operations have also been on a less extensive scale than those with the other two columns and have been confined almost entirely to the Khost, Kuram and Hariáb Valleys. From November 1878 to March 1879 Capt. Woodthorpe, B. E., was the only officer of the Survey of India present with the Column, but Lieut. Manners Smith, Adj. of the 3rd Sikhs, was attached to the Survey party in November to accompany and assist Capt. Woodthorpe, and in March Lieut. Gerald Martin, of the Survey of India, also joined the party.

Capt. Woodthorpe had the great advantage of being in close and direct communication with Genl. Roberts and of accompanying him on all expeditions and reconnaissances, and thus had every opportunity for seeing and surveying as much of the country as was practicable under the circumstances.

Capt. Woodthorpe accompanied the Force in the rapid advance in November 1878 from Thall to the Peiwar, partly along the right bank of the Kuram River, *via* Kapianga, Ahmed-i-Shamu, Esor, Hasár Pír, the Darwázá Pass and Kuram, plane-tabling along the route. He took part in the military operations of the 28th November and 2nd and 3rd December, and had a very narrow escape during the action on the 2nd.

He had gone forward with the advance when they reached the stock-ades on the Spin Gawai at dawn; and when all the enemy had been driven out he returned with a message from Colonel Brownlow of the 72nd to the

General, who asked him to take back a reply. He was returning by the route he had just traversed, quite alone, and had left the breastwork where the rest of the 72nd were sheltering about 48 yards in rear, when he saw some 80 men occupying the crest within a few yards of him, and in the grey light he mistook them from their dress for some of the men of the Force going up in support of the advance, and, on the other hand, the enemy did not recognise him till he was within 6 yards of them and then fired upon him. A bullet struck him on the left side, completely carrying away the whole of the wood of his pistol stock, tearing his clothes, singeing his side and driving a piece of his clothes into the middle of the note-book in his breast pocket and spoiling several sketches.

He fortunately succeeded in regaining the breastwork amidst a storm of bullets, notwithstanding that he tripped and fell heavily down-hill about half-way.

After the battle he made a reconnaissance of the scene of action. He then went on with the Force into the Hariáb Valley, marching and plane-tabling through Ali Kheyl and Rokíán, and was able to well delineate all the valley and as far as Rokíán. From Rokíán he was only able to carry on a route survey to the Shuturgardan, the valley being too narrow to admit of plane-tabling, and visits to places on either side were impossible. He was able to fix the Shuturgardan with sufficient accuracy and found it to be a good deal south-east of the position assigned to it on sheet No. 4 of the Atlas of India. The river a few miles above Rokíán runs north-east from the Surkai Kotal instead of rather south-east, as in the map. Capt. Woodthorpe says that the old map is exceedingly accurate as far as the Peiwar, on the north bank of the river, but he has been able to improve it a little. On returning to Ali Kheyl, he visited the Matungeh Hill, a peak about  $4\frac{1}{2}$  miles north of Ali Kheyl, about 12,900 feet above the sea, Ali Kheyl being 7,800. From Ali Kheyl he returned with the Force, marching and plane-tabling through Chapri and Karaia in the Mangal country, to Kuram. On passing through the Mangior defile between Chapri and Karaia on the 18th December, the baggage and rear-guard were attacked by Mangals.

Shortly after the return of the Force to Kuram, Capt. Woodthorpe and Lieut. Smith visited the Safed Koh, riding out from Kuram to some villages called Zerán, where they picked up a Turi guard, having also some Gúrkhas with them, and also had to change their mules for coolies, as they were told the mules could not go very far. They had, however, to take on the mules belonging to the Guard, as sufficient coolies were not procurable, and these mules got up within 2000 feet of the pass and would have gone right up, but there was no camping-place further on till the ridge was crossed and the road had descended again some distance towards the

plains. The route they followed was the regular Jelálábád road up which the Turi mules always go. They met a large number of unarmed traders coming in from Jelálábád. They reached a point about 13,000 or 14,000 feet high, but could not reach the highest point—Bodin Peak. The ridge was very steep and difficult and the path over snow-fields. From the point they reached they had a good view of the Fort at Kuram and all the peaks towards Khost. It was bitterly cold up there but they got angles to all the peaks they wanted.

Early in January the Survey party accompanied the expedition into the Khost valley, marching *viâ* Jaji Maidan, Bakk Akubi to Matún. From Matún Capt. Woodthorpe explored the valley to the west, in the direction of Degán, and also accompanied a signalling party to a hill on the watershed between the Shamil and Tochi rivers, near the small Wazirí village of Nandir, and commanding an excellent view of the surrounding country. From this point heliographic communication was established with Bannu and Hazár Pír. On the 27th January the Force left Matún, marching back to the Kuram *viâ* Sabari, Esor, Hazár Pír and Ibráhímzai. During this expedition the greater part of the Khost valley was surveyed and mapped on the  $\frac{1}{4}$  inch scale, the part wanting being at the extreme west.

After the return from Khost the survey party was engaged in making a route survey with plane-table and perambulator of the new road to Thall, *viâ* Ibráhímzai, Hazár Pír and Ahmed-i-Shamu; Capt. Woodthorpe also visited the Shobakgarh Range and fixed the position of the pass through that range to Khost.

About the middle of April the Survey party accompanied the Force to Ali Kheyi and remained there, surveying in the neighbourhood of the Peiwar, till the end of the month, the snow being about 18 in. deep on the hills at the time, and the weather very stormy and unfavourable for work.

Capt. Woodthorpe, accompanied by Lieut. Martin, paid a second visit to the Matungeh Hill, near Ali Kheyi, but they were disappointed in not being able to see and communicate with Gandamak, for which purpose signallers had accompanied them. They had a fine view, seeing far away into the plains near Ghazni and also to the Shuturgardan Kotal. The last 1500 feet of the ascent was very trying, on account of the snow with which the hill was covered and a biting cold wind that was blowing at the time, but notwithstanding this they managed to get through a good deal of work before returning to camp in the evening.

At the end of April Capt. Woodthorpe and Lieut. Martin went from Ali Kheyi *viâ* Belút to make a reconnaissance of the Lakarai Pass at the request of General Roberts.

From Belút the road lay along the bed of the Lalidar or Naridar stream

for some seven or eight miles, passing between thickly-wooded spurs of the mountains. It then winds up the spurs towards the Kotal, among the pines and here begins to be somewhat steeper, until it arrives at a small saddle from which to the Lakarai itself the slopes are somewhat alighter. From a little below this saddle to the Kotal the snow was very deep, 2½ to 3 feet. On the north side it was deeper still, and sometimes lies 7 to 8 feet thick. The height of the Kotal is about 10,600 feet.

They crossed the Kotal and continued some little distance down to where they could get a fairly good view of the river-bed and the villages below. The part of the road near the Kotal is called Mangal Tangi and the villages in the valley are Gabar Mangal. They are Taghan, Langar Kila, Sirkoti and Nazir Mahomed.

The nearest is Taghan, about five or six miles from the Kotal, and is a fairly large village. They were unable to go down to this village, partly because it was getting late and partly because the villages were unfriendly. They could see the tops of the Jizim and Jagdalak Hills and, as at Matungeh, some of Major Tanner's points, but the height of the Safed Koh on the right and the hilly nature of the country in front prevented their seeing Gandamak or Jagdalak. Lieut. Martin was also able to see the other side of the Safed Koh and so check, correct and add to the work he had done at Matungeh. The weather was very cold with a wind which almost made their fingers too numb to draw. Lieut. Martin gives a very graphic description of the beauty of the scenery, which he describes as quite Alpine.

During the month of May reconnaissances were made to the Sirkai and Shuturgardan Kotal; to the Zarrazod Peak, near the Mangior Pass; to the Istiar Pass and head of the Mangior defile, looking over the Ahmed Kheyl country; to the Kafirtaga Hill and to the Naktek Peak, over the Ahmed Kheyl and Lajji country, on which occasion a good deal of work was done and the positions of the Ahmed Kheyl and Lajji villages fixed, and a good deal of the topography between Ali Kheyl and the principal part of the Kuram sketched in as well as the ranges and principal water-courses on the opposite side.

Lieut. Martin gives some interesting details regarding the course of the Kuram river. There are two principal sources. One rises near the Shuturgardan, flows east and then south; the other rises in the Peiwar range, flows west and meets the former at Ali Kheyl and continues along with it in that direction until it arrives at the Ahmed Kheyl *great* village. Here the bed narrows and the closeness of the rocks gives it the name of "Tangi." This is the spot where the river suddenly turns south into a

mountainous land ; and here the Ahmed Kheyls have a fort and stop and rob travellers to Ghazni or those going by the Spiga Kotal to Kábul, and on this account (so he was informed) this road, though the best and shortest to Ghazni, is generally avoided. The Umar and other hill streams here join and all flow together through a very mountainous rugged country. This part of the Kuram then turns sharply eastwards and flows on towards Kuram itself. In this portion of its course myriads of mountain streams and torrents feed it and thus it increases in size rapidly. From the joining of the Ali Kheyl and Umar until it comes into the Kuram Valley its course is through a very mountainous country inhabited by various robber tribes, Mangal, Ahmed Kheyl and Lajji.

On the 20th June Capt. Woodthorpe and Lieut Martin, accompanied by other officers of the force and a party of signallers, ascended the Sikarám Peak (15,600 feet) on the Safed Koh, which had been already ascended by Mr. G. B. Scott, of the Survey, attached to the Pesháwar Column. Unfortunately the day was hazy and they were unable to see or do so much as they had expected.

The area surveyed by this party may be roughly estimated at 4,500 square miles and has been mapped and published on the scale of 4 miles to an inch.

### III. PESHÁWAR COLUMN.

The Survey operations with the Pesháwar Column, though not extending over such a length of country as those with the Quetta Column, have, perhaps, been more productive in new work, owing to circumstances having permitted a more complete survey of the country on either side of the route traversed by the Force than could be accomplished with the Quetta Column.

Five officers of the Survey Department—Major H. C. B. Tanner, B. S. C., Capt. E. W. Samuells, B. S. C., Capt. E. P. Leach, R. E., Capt. C. Strahan, R. E. and Mr. G. B. Scott, were employed from time to time during the occupation of the country by the British troops.

Of the operations connected with the earlier part of the campaign, the information furnished by the Survey Officers is unfortunately scanty. The results, however, speak for themselves.

Major Tanner completed a Military reconnaissance of the country between Jamrud and Jelálábád on the scale of 1 mile to the inch. Nearly the whole of the portion between Jamrud and Dakka, including the routes taken by the three brigades, was surveyed on the 2-inch scale by Mr. Scott, and afterwards reduced to the 1-inch scale in Major Tanner's office.

Major Tanner also made a reconnaissance on the scale of 1 inch to the mile of the hills lying to the immediate south of Dakka.

Capt. Samuells greatly distinguished himself at the taking of Ali Masjid by carrying on his survey under a heavy fire. Very shortly afterwards he was attacked with typhoid fever and died at Pesháwar on the 21st December, 1878.

Between the 1st November and 5th February, Mr. Scott had nearly completed a plane-table survey of 820 square miles-lying between Lat.  $33^{\circ} 55'$  and  $34^{\circ} 15'$ , Long.  $71^{\circ}$  and  $71^{\circ} 30'$ , comprising most of the country south of the Kábul river between Dakka and Fort Michni to the north, and in the neighbourhood of the Khyber and Bázár Valley to the south.

He was then called on by Major Hastings, the Deputy Commissioner of Pesháwar, to survey the portions of the Shinilo and Hyder Khán Kafilah routes to Dakka which he had not been able to complete before, and also to survey certain additional portions of the Kábul River. Whilst engaged on this work he and his party, which consisted of a few *kalashis* and a guard of 20 Sepoys and 2 non-commissioned officers of the 24th Panjáb, N. I., were attacked by a strong party of Momunds and a hand-to-hand fight ensued. Mr. Scott displayed great gallantry, coolness and good judgment on the occasion, and probably saved the whole party from destruction, as has been cordially acknowledged by the Panjáb Government and by His Excellency the Viceroy and Governor-General in Council.

Capt. E. P. Leach, R. E., joined the Force in January and did good service for about two months in surveying the Bázár Valley and a good deal of the country round Jelálábád, chiefly in the Shinwári country on the northern slopes of the Safed Koh. He was attacked on the 17th March by some Shinwáris, while surveying near the villages of Maidanak and Girdi, and received a severe wound on the arm, which obliged him to return to Pesháwar.

Capt. Chas. Strahan, R. E., replaced Capt. Leach in April and was employed in surveying the country in the neighbourhood of Safed Sang and to the north of the road between that place and Jelálábád.

On the occasion of the first expedition into the Bázár Valley by the Column under General Maude on the 20th and 21st December, Mr. Scott accompanied the Force and surveyed along the route. During the second expedition of the 24th January and subsequent days he again accompanied General Maude's Column *vid* Burg to China and completed a survey of the eastern part of the Bázár Valley and the scene of action towards Bara, while Capt. Leach, who accompanied General Tytler's Force from Basáwal *vid* Chunar and Sisobi to China, returning from China to Dakka over the



Sisobi Pass *viâ* Chunar, did a good deal of survey in the western part of the valley, and was able to fill in a considerable portion of the hill tract between Dakka and the Sisobi Pass, the position of which was accurately fixed.

While the Force remained in the valley no surveying beyond the immediate vicinity of the camp at China could be undertaken, nor any exploration made towards the Bara and Tirah Valleys, the Zakha Kheyls at once opposing the advance of any reconnoitring parties in those directions.

Capt. Leach remarks, as the result of observations on this expedition, that the passes over the Safed Koh apparently exist at intervals of 5 to 10 miles, and the one they crossed—the Sisobi—was under 5000 feet and a comparatively easy one for camels.

The higher ranges of the Safed Koh are fairly wooded, but the Kábul river runs through a bare stony plain from Jelálábád to the Khyber, and cultivation is very limited.

The most notable feature of the country is the elevated valleys which are composed entirely of beds of conglomerate brought down from the main ranges, and which rise gradually several thousand feet before the steeper slopes like those of the Himalaya commence. It is difficult to explain the formation, but it presents all the appearance of a sudden disintegration of the mountain ranges by volcanic action, the drainage lines cutting out broad channels in the most erratic manner over the deposit thus formed, and the spurs apparently having been half-buried by the immense masses of loose stone.

The route between Dakka and Jelálábád was surveyed by Major Tanner, the survey comprising nearly all the country between the road and the Kábul river and the villages 2 or 3 miles to the north of the river, and it was afterwards added to, chiefly towards the south, by expeditions from Jelálábád.

Capt. Leach, writing in January of the route between Dakka and Jelálábád, says that the country is disappointing and the fertile valley of Jelálábád, so far as he could see, was a myth. There are few trees and for several miles to the south of Jelálábád there are undulating ranges of low hills with broad expanses of waste land covered with stones. This is the character of the road the greater part of the way from Dakka, and the tract of country it passes through is to all appearances a continuous river-bed. Round Jelálábád itself there is a certain amount of irrigated cultivation, but the camp and roads were deep in dust and there is absolutely no vegetation on the hills.

Various attempts were made to explore the hitherto unknown tract of country lying along the northern slopes of the Safed Koh range to the

south of the Kábul river between Basáwal and Jelálábád. Regarding this tract Capt. Leach says the valley proper extends about 10 miles on the southern side of the Kábul river and is fairly level, then comes a belt of low broken hills inhabited by the Shinwáris and then the main spurs of the Safed Koh range which, in many cases, run nearly parallel to the main range and not at right angles, as shewn in existing maps.

The first of these expeditions was made by Major Tanner and Capt. Leach to the Shinwári village of Mazína, 14 miles south of Jelálábád, with a view to proceeding as far as possible towards the slopes of the Safed Koh and surveying the entrances to the Papin and Ajam passes; but as the Khán of Mazína refused to be responsible for any further advance into Shinwári country, the expedition had to be abandoned. Major Tanner was, however, able to fill in the drainage and low hills between Hínda and Mazína, and he remarks that the country between Hínda and the Mazína upland is intersected by numerous watercourses all paved with round boulders. The plain and broken ground between them is also thickly strewn with shingle and boulders, but after ascending a slight pass to the east of Za Khel, they suddenly found themselves in a beautiful plain highly cultivated and with forts and clumps of trees on all sides. The Safed Koh were but 10 miles off, with the valleys and slopes covered with beautiful pine forests. Between them and the foot of the mountains intervened more shelving stony ground with undulations that hid the cultivated lands of Deh Bala (the high village) from them. The cultivated lands stretch from Mazína northwards to Sher Sháh and almost reach the arid tract near the Chorazali road. Mazína is some 1200 feet above Jelálábád.

Early in March Capt. Leach received permission to survey over the old route between the Safed Koh and the Kábul river, followed by Burnes in 1839, confining his operations to the country eastward of Mazína. His first halting-place was at the Fort of a friendly Khán, 13 miles south of Jelálábád, and he had intended marching to Marhaiz, 9 miles further south and within 4 or 5 miles of the foot of the Safed Koh proper, whence he would have been able to get up to the lower spurs and snow-line, Marhaiz itself being 4000 feet; but as the Khán who escorted Capt. Leach said they would be certain to be attacked if they camped at Marhaiz, he changed his plan and went to his old camp at Mazína, where he had another day's work in the same direction and managed to get near enough to fix all the Shinwári villages at the foot of that particular part of the main range.

Capt. Leach says the country is a difficult one to sketch without actual survey.

The main range is easy enough and its features tolerably regular, but the lower slopes are completely buried by a glacis of low broken masses of

conglomerate and sandstone, so that the gorges to the passes and all the defiles are invisible till one is close to them, and nearly all the villages are quite out of sight. These lower ranges are generally detached and the valleys, or *daras*, are several hundred feet below them. He followed one of these *daras* down to its junction with the Kábul. For mile after mile they passed through a continuous belt of cultivation, thickly studded at every quarter of a mile with tidy-looking forts and showing every sign of comfort and prosperity.

Ascending either bank of the stream one passed at once from fertility to absolute barrenness, and a few miles away from the *dara* it was almost impossible to make out its course or to trace its windings through the hills to the foot of the range.

On the 17th March Capt Leach was surveying the slopes of the Safed Koh in the neighbourhood of the Shinwári villages of Maidanak and Girdi, from 16 to 20 miles south of Barikhab, when he was attacked by the villagers and after a hard fight succeeded in withdrawing his party and the military escort. In the course of the fight Capt. Leach was severely wounded by a sword-cut in the left arm, Lieut F. M. Barclay, who was in command of the escort of 45th Sikhs, received a wound which proved mortal, and two men were killed.

A few days afterwards an expedition under General Tytler was sent from Barikhab against the Shinwáris who had attacked Capt. Leach, Major Tanner and Mr. Scott accompanying the expedition as Surveyors. Major Tanner visited the scene of the encounter and was able at a height of 4,800 feet to see many points north and west of Jelálábád that he had never before seen, especially the Hindu Kúsh near Bamian, and the same range north of his position. He finds that Fardjgan is not at the foot of the Hindu Kúsh, but at the foot of one of its spurs.

Mr. Scott also accompanied General Tytler to the attack on Deh Sarak, and on this expedition and that to Maidanak made a reconnaissance of about 120 miles of Shinwári country and the neighbouring slopes of the Safed Koh.

The long halt of the Army at Jelálábád enabled the Survey Officers to make the most of such opportunities as they had for completing the survey of the almost unknown country around, but as a rule they were unable to proceed further out than the limit of a day's ride out and in, and this prevented them from extending their explorations so far as they would have been able to do under more favourable conditions.

During December and January the survey operations in the neighbourhood of Jelálábád were much hindered by a persistent opaque brown haze which entirely blocked the view beyond a few miles. Luckily Major Tanner was able to fix his position the very morning of his arrival, other-

wise he would not have been able to determine the true position for several weeks. And this was of the more importance because Major Tanner found that the position assigned to Jelálábád on existing maps was erroneous and that its true position is Lat.  $34^{\circ} 29'$ , Long.  $70^{\circ} 30'$ , instead of Lat.  $34^{\circ} 24'$ , Long.  $70^{\circ} 26'$ .

To the eastward, north of the Kábul river, Major Tanner accompanied an expedition through Kama into the hilly country beyond Girdao. Kama is described as a thickly-inhabited alluvial tract, intersected everywhere by canals and studded with many fortified villages and forts.

Major Tanner surveyed the course of the Kunár river for about 15 miles from its junction with the Kábul river, and filled in the country to the north of Jelálábád between the Kunár river and the Kábul and Lughmán rivers, known as the Dasht-i-Gambori, a waterless alluvial sandy plain, together with the hills to the north of it, to a distance of 16 to 18 miles from Jelálábád.

Major Tanner was also able to make a rough sketch of the Kunár Valley, filling in the names from native information. The course of the Kábul river, westward from Jelálábád beyond the Daronta Pass, was laid down to a short distance beyond its junction with the Lughmán River, about 14 miles from Jelálábád, and Major Tanner found that this part of the country was very erroneously delineated on the old map, the course of the Kábul River being placed many miles too far north.

On the occasion of the expedition to Lughmán under General Jenkins, the Lughmán river was traced by Major Tanner and Capt. Leach as far as Trigarihi, 26 miles from Jelálábád, and a fair survey was made of the Lughmán Valley from the Daronta Pass to the junction of the Alishang and Alingár Rivers. A more extended sketch, based upon trigonometrical points, was also obtained of the surrounding hills and heads of the above river valleys and extending westward to the Bád Pukht and Tang-i-Shaidán Passes. Observations were taken from a point 4,200 ft. on the Panchpai Range. The forces met with no opposition, and Major Tanner says that the people came in crowds round his plane-table, curious to see the English. He found the Tajik or Kunár language prevalent.

Accompanying a column under General Macpherson, Major Tanner surveyed the country between Jelálábád and Bahram Khán's Fort, going *via* the Tatang Pass, over the end of the Siah Koh Range, and returning along the foot of that range to Jelálábád *via* the Lakki Pass.

Previous to the advance of the army Major Tanner surveyed and fixed the course of the Surkháb River as far as Sultánpur, with all villages and many forts, thus completing the survey one march on the road to Kábul with all the country to the north of it as far as the Siah Koh Range.

On a subsequent occasion Major Tanner went to Sultánpur and surveyed a strip of the country south of the road, meeting nothing but a waste of stony hills and deep ravines. Low hills to the south prevented his seeing the cultivated tract and villages under the Safed Koh. It had been intended that he should survey Burnes' old route between Páthiábád and Chapriar and also that he should, if possible, visit and report on the bridge over the Surkháb river near Gandamak and also visit the old British cantonment at Kája, but unfortunately heavy rain stopped the work and the party were obliged to return to Jelúlábád.

On the advance of the army to Gandamak, in April, Major Tanner, Capt. Strahan and Mr. Scott accompanied the Force and surveyed the road to Gandamak and the country north and south of it between the Surkháb and the Safed Koh, Capt. Strahan taking the northern portion and Mr. Scott the southern.

In the reconnaissance to Gandamak Bridge (Safed Sang) Major Tanner found that the topography of the old map was very inaccurate. The general slope of the Surkháb is about 200 feet per mile and in one part the gradient of the plain which reaches to the foot of the Siah Koh was a great deal more, hence the unexpected bends and turns the streams make in a country covered with ridges and hillocks, where the southern edge has been upheaved in moderately late times.

Major Tanner also made a reconnaissance to the Wara Gali Pass, over the Siah Koh Range, extending as far as the watershed. The pass is easy but rocky. The slopes of the Siah Koh are craggy and have only sparse scrub for about half a mile. Unfortunately the weather at the time was bad and no observations could be made to peaks to the north.

Capt. Strahan's particular work was the survey of the country between Safed Sang and the Surkh Púl and he made a really fair survey (much more than a sketch or reconnaissance) of about 80 square miles north of the road up to the Surkháb and got a good general sketch of the Siah Koh beyond, up to the crest of the first range.

Capt. Strahan remarks that the name Safed Sang (white stone) had not been written against the camp so-called, because there is no village of that name, which refers to some big white stone in the river there. The nearest village is Hashim Kheyl. He also remarks that the weather at Safed Sang at the end of April was very changeable, one day high wind with dust, then cold wind with rain or hail, then a hot sultry day, the latter being the rarest and the other two about equal. The thermometer rose from 85° to 95° maximum, and was about 58° minimum.

The valley at Safed Sang is of no great width, and all the low ground within easy reach of camp was mapped by Capt. Strahan with very fair

accuracy and detail. From four stations round about he was able to fix almost every prominent point in the Safed Koh and Siah Koh and also in the Karkacha range some 25 miles to the west.

As soon as he heard that the troops were likely to return to India, Capt. Strahan sent Mr. Scott to the Safed Koh with instructions to get in all the sources of the Surkháb as far as possible, and to fill in all up to that river south of the road which will form the limit of the Survey. He himself started for the Siah Koh and did two days' good work from two peaks from which he had a most extended view. From the first he could see beyond Kábul and the Hindu Kúsh, somewhere near the Khevak Pass, but the high peaks there and about Kohistán and Panjshir were cloudy. From the second peak he could not see in the Kábul direction, but picked up some peaks on the Hindu Kúsh and got second rays to two peaks in Káfiristán, somewhere about the sources of the Alishang and Alingár rivers. He intended to have visited a third peak but was ordered to go with Capt. Stewart of the Guides, to Ali Khoyl by the Lakarai Pass over the Safed Koh. This attempt unfortunately failed.

Mr. Scott got to the top of the Sikarám Peak, on the Safed Koh (15,622 feet), and did a great deal of good work, observing to one solitary peak in the Hindu Kúsh in a part of the range unseen by any of the surveyors before, as it was hidden by the Káfiristán hills.

The total area actually surveyed during the progress of the operations of the Pesháwar Column may be roughly estimated at about 2,500 square miles, a great part of which is quite new and the remainder correction of the old, incorrect and imperfect surveys. Besides the above 1,100 square miles were sketched from native information by Mr. G. B. Scott. It has all been mapped and published on the scale of 4 miles to an inch.

During his stay at Jelálábád, Major Tanner took the opportunity of studying many points of interest connected with the numerous antiquities in the vicinity and the languages of the people, chiefly of the Káfirs.

At Háda, about five miles south of Jelálábád, he came across a splendid subterraneous palace of the old Káfir kings, known as the Palace of Oda, Hoda or Hodé Rájá, and had it excavated, finding several beautiful plaster heads and fragments.

He made some study of the language spoken north of the Kábul river, through Kunár, Lughmán, Kohistán &c. He says it has a most perfect grammar and is an Aryan language, he thinks very old and pure, and allied to that of the Káfirs, which he finds to be also Aryan and not Turanian. He had the names of several tribes of Káfirs, *viz.* Sána, Wáma, Kantáwar, Bukiwáma, Muliarwáma, Shinogur, Kaliagal, Waigal and Nishigam. Each tribe is said to have a separate language.

In the course of one of his excursions up the Siah Koh he collected

specimens of five kinds of pines. Of these the Chilgoza (edible pine) grows at from 7000 to 8000 feet; the Deodar from 7,500 to 10,500; the Palodā from about 9,000 to 12,500. A pine with small berries like an *arbor vitæ* grows above the deodars.

Major Tanner had all along been most anxious to avail himself of the rare opportunity which offered for exploring the interesting and almost unknown country of Káfiristán, and after a great many difficulties was able to make a start in that direction with the aid of the Chúganí Chief, Azím Khán, with whom he had an interview at Jelilábád through the instrumentality of Mir Ahmed Khán, of Shewa in Kunár, and Shaik Hussein Khán, also of Kunár. He describes Azím Khán as a handsome, pleasant looking man, of ruddy countenance, rather short, but as strong as Hercules. His followers also had soft pleasant faces. The chief presented him with honey, horns and cheese, and Major Tanner gave him presents of *lungis*, sweetmeats &c. in return; after receiving these the chief held out his hand and protested a lifelong friendship, declaring that his country and towns were open to Major Tanner at all times. He promised to take him all over Kohistán and to the gates of Káfiristán.

Notwithstanding the very disturbed state of the country north of the Kábul river, and its being in a state of anarchy, in which every man's hand was against his neighbour, Major Tanner started from Jelilábád on the evening of the 15th May, disguised as a Kábuli, with six of Ahmed Khán's men and two of his own. After a little difficulty at the ferry over the Kábul river, they crossed the plain of Besud and entered the Paikoh Tangi Pass. They walked quickly through the beautiful plain of the Kunár Valley and reached Ahmed Khán's Fort at Shewa, where he was well received by the owner. Hardly had they entered the Fort, which is really a walled village containing not only Ahmed Khán's houses but those of his retainers and friends as well, than there was a great disturbance and firing of shots caused by the discovery of people coming down on the ripening crops, but they were beaten off. The next day passed quietly. Major Tanner had arranged with the Chúganí Chief Azím Khán to meet him at Shewa and the chief had been with Ahmed Khán some days, but deferred starting owing to the disturbed state of the country. On the next morning, at dawn, a large party of Ahmed Khán's enemies, hearing of Major Tanner's arrival and of that of their enemy Azím Khán, attempted to surprise the Fort, but Mir Ahmed Khán having been informed beforehand of their intentions had taken precautions and they were driven off with the loss of three men.

Major Tanner took advantage of the defeat of these hostile clans to make a start before they could collect again and, all arrangements being

complete, he set off in the evening with five Chuganis, three of his own men and Azim Khán. The greater part of the road led along the bank of the Kunár river, which they left at Islámpur, and then commenced the ascent of the sloping terraces near the hills.

When near Budiali, being apprehensive of meeting enemies of Azim Khán and Ahmed Khán, as they had been all along the route, they made straight up the face of the hill near that town. These hills are absolutely dead and barren, but at about 800 feet they found tufts of grass and at 1000 feet a scrubby bush. In the morning they went down to the bottom of the range they had been climbing all night and then ascended another ridge, the hills changing in appearance as they climbed; at first a bush or a tree, then a wild olive, and, after going up some 1,500 feet, some green grass and a bush that bore some pleasant-tasting edible berries. The crest of this ridge was nearly 1,800 feet from the base and after proceeding along it for about an hour they reached one of Azim Khán's hamlets and rested there. The hills around were steep and craggy and supported stunted oak, wild olive &c., and at the rude huts there were clusters of date trees.

Major Tanner remarks that these are the only date trees he has seen so high as 4,500 feet, except those which grow at some places on the highest crags of the Western Ghats; but while on the Ghaut the fruit ripens about May, these trees showed no signs of buds even in that month.

Starting again, they followed the valley which rapidly ascended till they made the crest at 5,800 feet, and there they looked down on to Shúlút, about 1000 feet below them, and near the upper end of a narrow but highly cultivated valley. Shúlút was reached at sunset, and Azim Khán advised Major Tanner to pass himself off as a Khán from Kábul travelling to see the country, for the village was inhabited partly by his men and partly by another tribe. His Kábuli disguise had been hateful to him all along, but he was glad of it now because the people in a friendly sort of way came and sat down and moved about among the party at their pleasure. He was given food, a *chupatti* and a piece of cheese, but was too much fatigued to eat much. After a good sleep they went off early in the morning and ascended the pleasant valley of Shúlút. Oaks and olives clothed the sides of the hills and carefully-terraced fields were ranged along the sides of the streams. The notes of parrots, blackbirds and cuckoos were heard and little birds twittered in the branches. They crested the head of the valley at 7,800 feet and a noble view was before them. On one side Kúnd and its pine-clad spurs and white rounded snow crests, and on the other the Kunár valley, and beyond it the Bajour and Momund Hills. Below these were the terraces of Aret and just above them the chief town of that name, just clinging to the sides of a steep spur. Besides the chief town were smaller



ones in different parts of the valley. Every possible spot was terraced, and there did not seem room for another acre of cultivation in the neighbourhood.

They had a descent of over 2000 feet, and at 5,200 reached the beautiful mountain torrent that waters the cultivation. Crossing it by a wooden bridge, they passed under groves of walnuts and along the edge of delightful terraces of waving wheat. There was foaming and rushing water everywhere, and creepers and ferns grew in the crevices of the rocks, and on the flatter parts of the craggy spurs grew oaks and wild olive. Houses built partly of wood and partly of stone, with flat roofs and carved supporting posts and bearers, were situated here and there, sometimes in groups and sometimes singly on the most exposed positions. The chief Azim Khán conducted Major Tanner to a house some 200 feet above the stream and about half a mile from the chief town. Up the valley, looking past walnut groves, terraces and hamlets, he could just see the round snow peaks of Kúnd, rising out of the black pine forests that clothe the mountains from 7000 to about 11,000 feet. Below were groves, scattered houses and the roaring torrent fed by the snows of Kúnd. From all he could gather this collection of villages does not much differ from those of the Káfirs who build partly of wood and partly of stone.

Major Tanner says of the principal village that the houses are piled one above another, and every beam, doorway and shutter carved in a most elaborate manner. The designs are crude, it is true, but such a mass of carving he had never before seen anywhere.

In the principal town there are many hundred houses, and in the whole group he was told there were 1000, and this cannot be over the mark.

Major Tanner's arrival caused a disturbance on the part of the inhabitants which was only put down by the Chief's authority. He is all powerful and his word appears to be law.

In Aret, the largest Chúganí colony, there is no *baniya*, so that the people have to take their goods two days' journey before they can find a market.

Major Tanner found Chúganistán more extensive than he had been given to understand it was. What the number of the tribe may be Azim Khán could not say, but in the valley of Aret alone, there must be at least 5000 and they have many villages, or rather the heads of many valleys, the lower portions of which are inhabited chiefly by the Safis, the hereditary enemies of the Chúganis. The Safis are Afgháns and the Chúganis in Major Tanner's opinion are converted Káfirs. He liked the Chúganis; they are a quiet set, said to be faithful to their masters and true to their engagements. They are brave and well-disposed towards the English and,

Major Tanner thinks, would probably offer a good field for recruiting amongst a hardy race who have no sympathy with the Afgháns.

Major Tanner says that Azím Khán's wife and children moved about among them, and did their household duties without any shamefacedness. As they came up the valley, all the women greeted the Málík with a smile, and conversed without restraint. The young women have very handsome features, and some are very pretty but much disfigured by dirt.

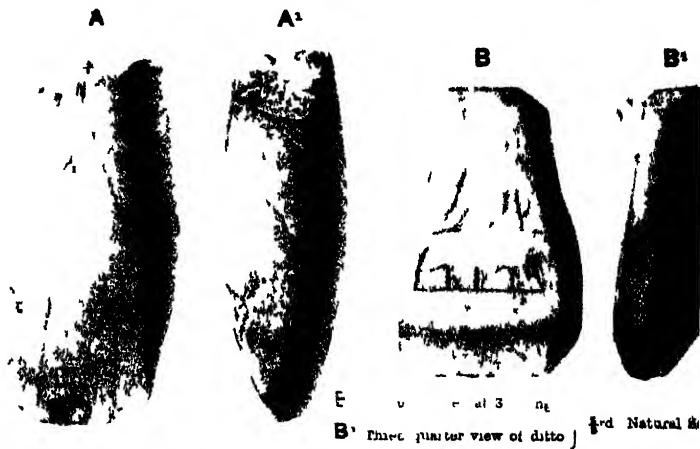
A few days after Major Tanner's arrival in Aret, he had a bad attack of fever, which he got over and, though weak, made all arrangements for a final advance, when he had a second and very severe attack to which he nearly succumbed and which compelled him, most unfortunately, to abandon his design and return to Jelálábád.

After an appeal to Azím Khán's 'friendship', he was allowed to leave and was carried off between two poles to Jinjapur, about two days' journey. By the kindness of the Jinjapur Málík he was safely conducted by the Málík's two sons and a large armed party, through a hostile country to the mouth of the Dar-i-nur, and eventually he reached Ahmed Khán's Fort at Shewa where he was safe, though the Fort was attacked immediately after his arrival by an armed party they had met on the road when going down the Dar-i-nur.

From Shewa he went down the Kunár river to Jelálábád on a raft.

The untoward failure of this expedition is much to be regretted as Major Tanner would undoubtedly have been able to throw much light upon this little known country had he been able to carry out his plans.

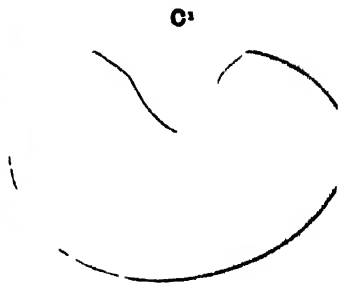




A Cell found *in situ* at Shillong

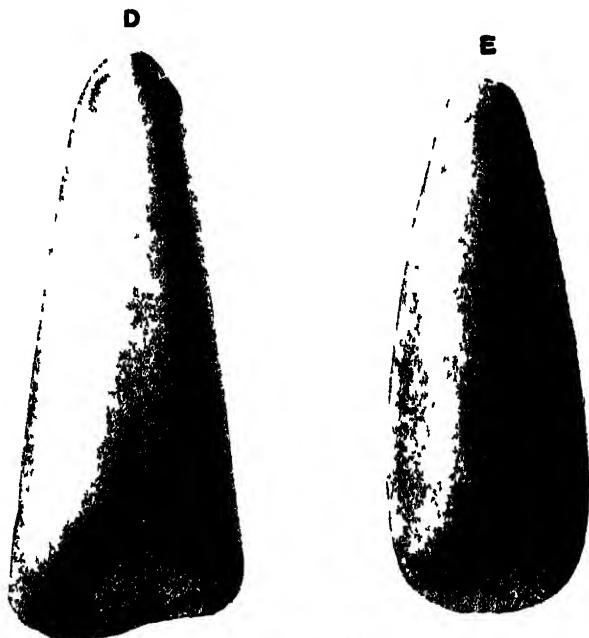
A' Three quarter view of ditto }  $\frac{1}{2}$ rd Nat. & 5/16

B Three quarter view of ditto }  $\frac{1}{2}$ rd Natural size



C Oval tool-stone from Banda } Full size.  
C' Section of ditto.





$\frac{1}{2}$ rd Natural Scale

F Full Size.

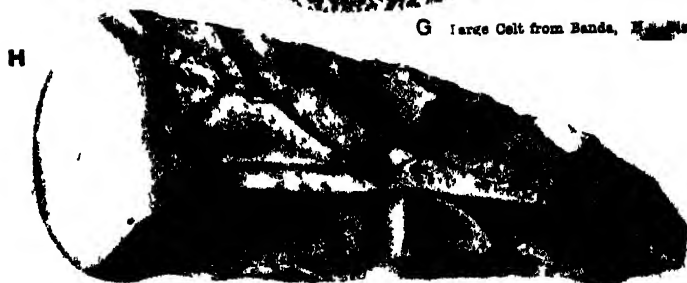


D. E. F Cells from Vellore, Madras Presidency.





G Large Celt from Banda, N. E. India



H Elongated chipped implement from Banda. Full size





# CONTENTS

## OF THE NATURAL HISTORY PART (PT. II.) OF THE JOURNAL OF THE ASIATIC SOCIETY OF BENGAL FOR 1878.

---

No 1, (issued May 21th, 1878) *Description of* *Ruticilla schisticeps* *Hodge*—By W T BLANFORD. *Aberrant Dentition of Felis Tigris*.—By R LYDEKKER. *Record of the Occurrence of Earthquakes in Assam during 1877*—Communicated by COLONEL R H. KEATINGE. *Sixth List of Birds from the Hill Ranges of the North-East Frontier of India*.—By MAJOR H H. GODWIN-AUSTEN—*An Account of the Tidal Observations in the Gulf of Outch, conducted by the Great Trigonometrical Survey under the superintendence of COLONEL J. T. WALKER. Compiled from the G T Survey Reports by CAPT J. WATERHOUSE.*

No 2, (issued July 10th, 1878) *The Application of Photography to the Reproduction of Maps and Plans by Photo-mechanical and other processes*.—By CAPT. J. WATERHOUSE; (with one Plate).

No 3, (issued Oct. 25th, 1878) *Notes on some Reptilia from the Himalayas and Burma*—By W T BLANFORD. *Notes on the Earthquake in the Punjab of March 2nd, 1878*—By A. B. WYNNE. *Notes on the Land and Fresh-water shells of Kashmir, more particularly of the Jhelum valley below Srinagar and the hills North of Jammu*.—By W. THEOBALD. *On some Mammals from Tenasserim*.—By W. T. BLANFORD, (with three plates). *List of Hymenoptera obtained by OSHIAN LIMBOG, east of Maulmain, Tenasserim Provinces, during the months of December 1876, January, March, and April 1877, with descriptions of new species*:—by F. SMITH. Communicated by J. WOOD-MASON. *Preliminary Diagnoses of new Coleopterous Insects belonging to the families Dytiscidae, Staphylinidae, and Scarabaeidae, obtained by the late F. STOLICZKA during the 2nd Mission to Yarkand under SIR DOUGLAS FORSYTH*.—By D. SHARP.

No. 4, (issued April 8th, 1879). *Description of a new Lepidopterous Insect belonging to the genus Thaumantis*.—By J. WOOD-MASON. *Great Snow-fall in Kashmir*.—By R. LYDEKKER. *Physiographical Notes on Tanjore (Tanjâûr)*.—By LT-COL. B. R. BLANFILL, Deputy Superintendent, Great Trigonometrical Branch, Survey of India. Communicated by COLONEL J. T. WALKER.—*On the proper relative Sectional Areas for Copper and Iron Lightning rods*.—By R. S. BROUGH. *Description of a New Homopterous Insect belonging to the Genus Cosmocarta*.—By W. L. Distant. *On the Indian Species of the Genus Erinaceus*.—By J. ANDERSON.—*Description of a supposed new Hedgehog from Muscat in Arabia*.—By W. T. BLANFORD. *On Arvicola indica, Gray, and its relations to the Sub-Genus Nesokia, with a description of the species of Nesokia*.—By J. ANDERSON.

# PUBLICATIONS

FOR SALE AT THE

## ASIATIC SOCIETY OF BENGAL,

*No. 57, Park Street, Calcutta.*

RS. AS.

|                                                                                                                                                                                        |    |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---|
| Journal, Asiatic Society, Bengal, from Vols. XII to XVII (1848 to 1848) ; Vols. XIX to XXII (1850 to 1852) ; Vols. XXVI, XXVII (1857, 1858), and Vols. XXXIII to XLIV, (1864 to 1875). |    |   |
| Asiatic Researches, from Vols. VI to XII and Vols. XVII to XX, each at .....                                                                                                           | 10 | 0 |
| Ditto ditto, Index, .....                                                                                                                                                              | 5  | 0 |
| Catalogue of the Books and Maps in the Library of the Asiatic Society, 1856, .....                                                                                                     | 8  | 0 |
| — of Sanskrit Books and MSS. in ditto, .....                                                                                                                                           | 1  | 0 |
| — of Books and MSS. in Arabic, Persian, and Urdu, .....                                                                                                                                | 1  | 0 |
| The Ain-i-Akbari, Vol. I. Translated into English, with notes and indexes, by H. Blochmann, M. A., .....                                                                               | 12 | 4 |
| The Prosody of the Persians.—By H. Blochmann, M. A. ....                                                                                                                               | 5  | 0 |
| The Tabaqat-i-Nâcirî. Translated by Major H. G. Raverty, 8 fasc.,                                                                                                                      | 8  | 0 |
| Aborigines of India, by B. H. Hodgson, Esq., B. C. S., .....                                                                                                                           | 8  | 0 |
| The Antiquities of Orissa, Vol. I.—By Rajendralala Mitra, .....                                                                                                                        | 35 | 0 |

*Now Ready.*

UNDER SUPERVISION OF MAJOR H. H. GODWIN-AUSTEN.

REPRINT OF

## JERDON'S BIRDS OF INDIA.

To which have been added his "Supplementary Notes" to the above work, published in the "Ibis." These extend the Catalogue of the Indian Avifauna considerably to the Eastward of the Teesta and Brahmaputra Rivers, or the Eastern limit laid down in Dr. Jerdon's original work, 3 Vols. 8vo., Rs. 82, (exclusive of packing and postage).

As only a limited number of copies have been printed, early application should be made to

P. S. D'ROZARIO & Co.,

Publishers,

12, Waterloo Street, Calcutta.

*Remittances to be made payable to Manager, Agra Bank, "Limited."*

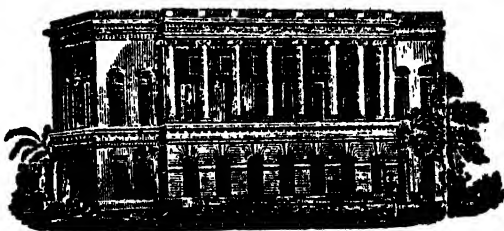
# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.

Vol. LIII, Part II, No. III.—1884.

EDITED BY  
THE NATURAL HISTORY SECRETARY.



"The bounds of its investigation will be the geographical limits of Asia; and within these limits its inquiries will be extended to whatever is performed by man or produced by nature."—SIR WILLIAM JONES.

•• Communications should be sent under cover to the Secretaries, *Asiat. Soc.*, to whom all orders for the work are to be addressed in India; or, in London, care of Messrs. Trübner and Co., 57 & 59, Ludgate Hill.

CALCUTTA:

PRINTED BY J. W. THOMAS, AT THE BAPTIST MISSION PRESS,

AND PUBLISHED BY THE  
ASIATIC SOCIETY, 57, PARK STREET,

1884.

Price (exclusive of postage) to Subscribers, Rs. 1-4. — To Non-Subscribers Rs. 2.  
Price in England, 4 Shillings.

Issued April 22nd, 1885

## CONTENTS.

---

|                                                                                                                                                                                                                                                                                                   | <i>Page</i> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| IV.— <i>Some Rough Notes for the Construction of a Chapter in the History of the Earth.</i> —By R. D. OLDHAM, A. R. S. M., Assistant Superintendent, Geological Survey of India, .....                                                                                                            | 187         |
| V.— <i>A new Species of Simulium from Assam.</i> —By DR. EDWARD BECHER, Vienna. Communicated and translated by the NATURAL HISTORY SECRETARY (With Plate XIV), .....                                                                                                                              | 199         |
| VI.— <i>Variations of Rainfall in Northern India during the Sunspot Period.</i> —By A. N. PEARSON, Esq., Officiating Meteorological Reporter for Western India. Communicated by the PRESIDENT (With Plate XI), .....                                                                              | 201         |
| VII.— <i>Description of a new Lepidopterous Insect belonging to the Heterocerous Genus Trabala.</i> —By F. MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY, .....                                                                                                         | 205         |
| VIII.— <i>Phyllothelys, a remarkable Genus of Mantodea from the Oriental Region.</i> —By J. WOOD-MASON, Deputy Superintendent, Indian Museum, Calcutta (With Plate XII), .....                                                                                                                    | 206         |
| IX.— <i>Notes on Indian Rhynchota, No. 1.</i> —By E. T. ATKINSON, B. A., .....                                                                                                                                                                                                                    | 210         |
| X.— <i>List of the Lepidopterous Insects collected in Cachar by MR. J. WOOD-MASON, Part I.—HETEROCERA.</i> —By F. MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY, .....                                                                                                  | 234         |
| XI.— <i>Revised Synopsis of the Species of Choroedodis, a remarkable Genus of Mantodea common to India and Tropical America.</i> —By J. WOOD-MASON, Officiating Superintendent, Indian Museum and Professor of Comparative Anatomy & Zoology, Medical College, Calcutta (With 15 Woodcuts), ..... | 238         |

---

# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.

---

### Part II.—NATURAL SCIENCE.

No. III.—1884.

IV.—*Some Rough Notes for the Construction of a Chapter in the History of the Earth.*—By R D OLDHAM, A. R. S. M., *Assistant-Superintendent, Geological Survey of India*

[Received Aug 30th ;—Read Sept. 3rd, 1884.]

To the coal-miner, or to the mere geological surveyor, the exact correlation of the rocks in different parts of the world is of little importance. Little does the mine-owner reck of whether his coal does or does not belong to the carboniferous era so long as it is saleable at a profit, nor need the geologist, asked to survey and report on a coalfield, trouble his head about this ; but, to one who would unravel the physics or the history of the earth, the solution of this problem may well be of paramount importance, though unfortunately often impossible of attainment ; generally, one might almost say always, he has to depend on fossils, but the answers these give are often contradictory or Delphic in their obscurity ; at no time should they be too literally interpreted, but, like the cutcherry gong in an Indian station, must be made the most of as the only available substitute for a more accurate timepiece. But just as in this city where there are many thousand timepieces of various descriptions of which probably no two keep identical time, every day the time-ball falls and the signal gun is fired to let all who may be concerned know that it is one o'clock ; so in the past time-signals have been given throughout the earth, by which we can determine the contemporaneity of the strata in which their records have been preserved. Of this nature would be a wide spread glacial epoch comparable to that which in the

recent past has affected both hemispheres of the globe, but, as there is reason to believe that such have occurred at various periods in the history of the earth, we are dependent on the otherwise less accurate palaeontological evidence for determining whether the strata shewing signs of glacial action can have been deposited at the same period or must belong to widely separated geological epochs.

There can be no doubt that of all forms of palaeontological evidence the most trustworthy is that afforded by the marine mollusca. Inhabiting as they do an element of more uniform temperature, and of which every part is in continuous if circuitous connection with the rest, it is but natural that they should be more uniform in character than the fauna of the land, while the simplicity of their structure, greater than that found among vertebrates or higher invertebrates, renders them less liable to change through alteration of the conditions under which they live. On the other hand, this very stability of organism renders them useless for the exact correlation of strata far separated from each other; for mere determination of homotaxy, even did this exist in the sense in which the term was originally intended to bear, would be but of little value to the physical geologist, to whom the terms 'Jurassic' or 'Carboniferous,' if determined merely on palaeontological grounds, are as meaningless, for determination of dates in the history of the earth, as the analogous terms 'Stone Age' and 'Bronze Age' are for determining periods in the history of the human race.

But, if the evidence afforded by marine mollusca is not sufficiently accurate and trustworthy, how much more is this true of that afforded by the terrestrial fauna and flora. True, the duration of the existence of a species of cycad, conifer, and, possibly, even a fern may be shorter on the average than that of a species of mollusc, and to this extent it may be a more accurate index of contemporaneity; but it is comparatively seldom that identical species are found in far separated deposits, and palaeontologists have consequently to depend mainly on what are called 'allied species.' Now the hard parts of animals, which in almost every case are all that are preserved to us, give, for the most part, a very true and real indication of the affinity of the animal to which they belonged, while, from the leaf of a tree or the frond—generally barren or with the fructification obliterated in fossilisation—of a fern, little or nothing can be gleaned of the relationship of the plant to which it originally belonged; thus no one would doubt that two specimens of *Trochammina* or *Ammonite*, declared by a competent palaeontologist to belong to the same species, would, if we could recover their soft parts, still prove to belong to the same or very closely allied species, while, on the other hand, we have lately been informed, by a palaeobotanist whose competence none

can doubt, that the Indian and Australian forms of the celebrated *Glossopteris browniana*, long believed to belong to the same species, differ so widely in their fructification that it is doubtful whether they can be included in the same family, and that they must certainly belong to different genera.\*

As an instance of uncertainty of palaeontological evidence, I need only quote the well-known case of the Umia and Katrol beds of Kutch, where beds containing a flora with a well-marked Lower Oolite facies overlies other beds in which the fauna is equally distinctly Upper Oolite in type; another case that might be quoted is that of the Rajmahal and Damuda floras; in the Rajmahal flora, there are, out of 47 species† in all, 26 which are identical with or allied to‡ European species: of these, fifteen are represented in the Rhætic beds of Europe, one species being hardly distinguishable from the European form: seven are represented by Palæozoic species, two belonging to an exclusively Palæozoic genus (*Eremopteris*), while another (*Macroteniopteris lata*) is, on Dr. Feistmantel's own admission, so like the Permian *Teniopteris abnormis* as to be almost undistinguishable: two species only are allied to Liassic forms, and of these one is also represented in the Rhætic: five species are represented in the Lower Oolite of Europe, two by identical forms, while, of the other three, one is also related to a Carboniferous, and the other two to Rhætic, species. From this, an impartial observer would be inclined to place the flora as certainly not later than Rhætic, but, as on this point the talented palaeontologist of the Geological Survey has expressed a very positive opinion that the flora is Liassic in facies, I must perforce

\* *Palæontologia Indica, Fossil Flora of the Lower Gondwanas, Vol. III, p. 108* In this connection, I may quote Dr. Feistmantel as follows:—after noting the difference in the fructification of the two forms, he adds 'so that I would be quite justified in placing these in a separate genus altogether and thus disposing of the difficulty in determining the age of our Damuda series owing to the correlation of the Indian Australian species.' An easy way of 'disposing of the difficulty' forsooth, but my colleague can hardly have perceived the full force of these words when he penned them, for, carried to their legitimate conclusion, they cut away the ground on which alone palæobotanists can base their claim for the acceptance of fossil plants as a means of correlating distant deposits. The lesson to be learnt is rather that the conclusions of even the ablest palæobotanists must, owing to the nature of the materials they have to work with, be received with caution, and that generic and specific names of fossil plants do not necessarily represent any real affinity, and that in some cases the latter and in most cases the former are names merely and nothing more.

† Here and elsewhere, except where the reverse is distinctly stated, I owe my palaeontological facts to Dr. O. Feistmantel's writings in the publications of the Geological Survey of India.

‡ I use this term in the same sense as it is used by palæobotanists; it may well be that some of these 'allied species' have no real connection with each other.

bow to his opinion, a feat I can the more easily perform that the exact determination of the age of the Rajmahal series is irrelevant to my present purpose, this being merely to point out that the flora, judged by European standards, is of an extremely heterogeneous character.

Turning now to the Damudas, we find that, out of a total 63 species, only twenty shew any affinity to European forms: of these, six are represented by Rhætic species, two of which are identical in Europe and in India: eight are represented in Jurassic beds, one being identical with a species from the Yorkshire Oolite, and two have their nearest allies among living forms: while, of those which are related to species older than the Rhætic, two are represented in the Permian, and two only are represented by allied species in the Trias. The flora of the Damudas is thus seen to be as heterogeneous in its character as that of the Rajmahals and, like that of the latter, would naturally be attributed to a Rhætic age, yet the two series are not merely separated by a break in the stratification, but the two floras are so contrasted in their characters that, whereas the Damuda flora is almost exclusively composed of ferns, that of the Rajmahals is markedly the preponderance of cycads, and, of all the Rajmahal species, three only are represented in the Damudas and those by "allied species." These beds have been classed by Dr. Feistmantel as Triassic, and the probabilities in favour of their being contemporaneous in the Trias of Europe are about the same as those in favour of a Liassic age for the Rajmahals or a Rhætic age for either of the two, but this is all that can safely be said.

Turning now to the Kach flora, which, whether we judge from the associated marine fauna or from the flora itself, is of Oolitic age, we find, out of a total of 27 (excluding Algæ) species, 18 are represented by identical or allied species in Europe, four are identical with European Oolitic species, of which, however, one ranges down to the Rhætic, nine more forms are related to European Oolitic species, while four only are related to species older than the Oolite and in two cases at least the relationship is not very close; we have here, then, a much closer relation with a definite European flora than is the case with the Damuda and Rajmahal beds, and this, as I shall presently shew, is of considerable importance in unravelling the history of the Gondwana age.

In Australia, there is a series of plant-bearing beds whose flora shews many affinities with that of the Indian Gondwanas, but which range over a more extensive period of time, and are marked, both at their upper and at their lower limits, by the association of the plants with marine fossils.\*

\* Conf. principally Rev. W. B. Clarke, Remarks on the Sedimentary formations of New South Wales, 4th edition, and Dr. O. Feistmantel in *Palæontographica*, 1878 (Appendix).



At the base of the series, are beds whose marine fauna indicates a Devonian age; above these, come beds which contain a flora consisting principally of such genera as *Lepidodendron*, *Rhaconopteris*, and *Calamites*, among which occurs a single species of *Glossopteris*.\* Above these, but still below beds in which a marine fauna of Carboniferous type is found, there is a flora which, judged by European standards, is Mesozoic in facies. At the top of the Newcastle series, to which the beds just mentioned belong, a more abundant flora is found, which presents many relationships to that of our Indian Damudas: in both, *Glossopteris* is a dominant type, both contain the *Glossopteris browniana* and two other species allied to Damuda forms: *Sphenopteris*, which in the Newcastle beds is represented by six species, is only represented in the Damudas by one (*S. polymorpha*, Fstm.), which, however, is said to be more closely allied to the Australian *S. alata* than to any European form: the only species of *Phyllothea* is allied to the Damuda *P. indica*, and the common occurrence of *Vertebraria* in both is another link. That this relationship is not so close as was at one time believed, I readily admit, but nevertheless the relationship is real, and, though it may be presumptuous to express an opinion at variance with that of the talented palaeontologist of the Geological Survey of India, I must say that to me the relationship seems far closer than that which unites the Damudas to the Trias of Europe.

Above the Newcastle beds, come the Hawksbury beds, which have yielded but two species of ferns, one of which (*Sphenopteris alata*, Bgt.), however, is allied to a Damuda species. Above the Hawksbury, come the Wianamatta beds, which have yielded six species of plants, no less than three of which are allied to Damuda forms.

It is thus evidently impossible to correlate, on palaeontological grounds alone, these beds directly with any of our Indian horizons, but, like the Indian Talchirs, the Hawksbury beds contain certain beds of fine clay through which boulders of all sizes are scattered promiscuously in a manner that can only be attributed to the agency of floating ice. In Victoria, there are beds which similarly indicate the existence of a severe climate at the time of their deposition, and these—the Bacchus Marsh beds—have yielded three species of *Gangamopteris*, of which one is identical with, and the other two are closely allied to, Talchir species. The Bacchus Marsh beds have not yielded a single species common to themselves and to the Hawksbury beds, but this is of little importance, as it is impossible to suppose that the entire flora of the Bacchus Marsh period consisted

\* There is some doubt attaching to the correctness of this statement. The *Glossopteris* was obtained from a different locality and possibly from a newer series of beds than the others.

of three species of *Gangamopteris*, or that of the Hawksbury period to have been limited to two species of ferns. But, if not directly referable to the same epoch by their contained fossils, there can be no doubt that they are on the same horizon, for, in the uppermost beds of the Newcastle series, two species of *Gangamopteris* are found, one identical with, and the other allied to, species from the Bacchus Marsh sandstones of Victoria, while the beds above the Hawksbury series in New South Wales can be correlated with those which overlie the Bacchus Marsh beds in Victoria by the occurrence of *Pecopteris australis*, Morr. and *Tenopteris daintreei*, McCoy in both. The presence of beds indicating glacial action in both and the absence of similar beds in the associated strata further prove their absolute contemporaneity; and by an extension of the same reasoning we may assign the Talchirs of India to the same glacial epoch.

The palaeontological relations of the Gondwanas with the Karoo and Uitenhage series of South Africa are much simpler than with the Australian formations. From the upper part of the Karoo beds, which unconformably overlie strata containing an Upper Palæozoic fauna, a limited flora of but five species has been obtained. Of these five, one is *Glossopteris browniana*, another, *Dictyopteris ? simplex*, Tate, is, according to Dr. Feistmantel, allied to *Glossopteris damudica*, Fstm., and *Rubidgea mackayi* is, on the same authority, probably a *Gangamopteris*; in addition to these, Tate gives a species of *Phyllothea*, but the identification is doubted by Dr. Feistmantel.\* Associated with these, there is an abundant and peculiar Reptilian fauna with *Diocynodon* as a dominant type, a genus not known elsewhere, except from the Panchet subdivision of the Damuda in India. In the overlying Uitenhage series, there is a flora consisting of eleven determinable species; of these one species of ferns is also found in the Rajmahala, while two, and possibly three, species of ferns and one conifer are closely allied to Rajmahal forms.† These Uitenhage plants are associated with beds containing an Oolitic marine fauna. The palaeontology of these beds sufficiently indicates a parallelism with the Gondwanas, and, in confirmation of this, we find, at the base of the Karoo series, an undisputably glacial boulder bed,‡ which we shall be justified in assigning to the same epoch as those of the Talchirs in India and of the Hawksbury and Bacchus Marsh beds in Australia.

Viewing these circumstances, there can, I think, be no doubt that these glacial boulder clays of Africa, India, and Australia represent one and the same epoch in the history of the earth and are, as strictly as the word can be applied, of contemporaneous, if not absolutely coeval, origin.

\* Q. J. G. S., XXIII, 140, *Palæontographica*, 1878, p. 114.

† Q. J. G. S., XXIII, p. 140.

‡ Q. J. G. S., XXVII, 58 and 585.

And further, as in every case the paleontological evidence indicates that these glacial beds are of late Palaeozoic or early Secondary age, I think it is probable that, as has been suggested by Mr. H. F. Blanford, they are of the same age as the Permian boulder clays of Europe.\*

Having thus obtained a common era in the geological history of these three countries (India, Africa, and Australia), we are able to examine their history in an intelligent manner. The first thing noticeable is that, in Australia, at a period corresponding fairly to the Devonian, both the fauna and the flora were, judged by European standards, of a Palaeozoic type. Later on, probably in Lower Carboniferous times, there appears, among species of *Lepidodendron*, *Rhacopteris*, and *Calamites*, which, in Europe, are found in rocks of Carboniferous age, a single species of *Glossopteris*, the forerunner of a newer flora destined to supplant the older forms. In the Newcastle (Upper Carboniferous) beds, this flora has completely ousted the older forms, and, as I have already noticed, shews considerable relationship to that of the Damudas in India. Yet, if the Talchurs and the Bacchus Marsh beds are really of contemporaneous origin as was first suggested by Dr Feistmantel, and if the Bacchus Marsh and Hawkebury beds are also contemporaneous (and the presence of traces of glacial action in all three is at least presumptive evidence in favour of this conclusion), the Damudas must be of very much later date than the Newcastle beds, and we have to explain why it is that the Newcastle flora left Australia when it did, and why it or its descendants lingered on in India, and, as I propose to shew, spread over what is now the Old World producing important modifications in its flora.

It is possible to suppose that the Newcastle flora required a warm—though from internal evidence one would rather look upon it as indicating a cool temperate—climate; that, on the advent of more severe conditions, it migrated towards the Equator and remained there, not merely through a period of extreme severity, but through a further period, when the climate was cooler than it had been during the deposition of the Newcastle beds, and during which a flora more suited to the latitude flourished in Australia. But there are so many objections to this hypothesis that it can hardly be tenable, and, however wild my alternative hypothesis may be thought, I hope to prove that it is really the more probable of the two.

In the first place, we have to account for the prevalence of glacial conditions at a low level in India even within the tropics. This was not paralleled during the last glacial period, for even the erratics of the *Petwar* are 10 degrees beyond the tropics and 2,000 feet above the level

\* This correlation of the Indian, African, and European boulder beds has been suggested by Mr. H. F. Blanford, *Q. J. G. S.*, XXI, p. 319.

of the sea, while the Petwar was certainly not less elevated during the glacial period than it is now. Further, the glacial deposits in India are far better developed, and, to judge from the descriptions, must be far thicker and represent a much longer period of time during which the climate was severe than those in Australia. Yet the glacial deposits of New South Wales are  $10^{\circ}$  further from the Equator than the Indian, so that, if we might shift the Equator some  $10^{\circ}$  further south between India and Australia, observed facts would be more in accordance with what one would expect than can be the case if we are compelled to assume the Equator fixed throughout all time.

But, if we try to compare the facts observed in Australia and Africa, we are landed in a still greater difficulty, for, lying as they do on about the same parallel of South Latitude, the glacial beds are more strongly developed in Africa even than in India, and, as we can hardly suppose the greater severity of climate to be due to altitude, it must have been due to latitude, to obtain which we must suppose that that portion of the Earth's crust which now forms South Africa then lay in a higher latitude than that which is now Australia; in other words, the comparison of the Permian (?) glacial beds of Africa and Australia, as in the case of Australia and India, points to the conclusion, either that there has been a change in the position of the axis of revolution of the earth, or, what is more probable, that the crust of the earth then occupied a position relative to the central nucleus different from that which it now does. An experiment with a globe will shew that the relations of India, Australia, and Africa indicated above, *viz.*, that Central India was in a higher latitude than New South Wales and South Africa in a higher latitude than either, are best satisfied by taking the Equator between India and Australia, but nearer the latter than is now the case, and thence through a point lying between the Cape of Good Hope and the South Pole in not less than  $70^{\circ}$  of South Latitude; a disposition which would bring some point in Central Africa over one of the poles.

Turning now from these physical and climatic arguments to those derivable from paleontology, I hope to shew that they lead to the same conclusions.

I have already referred to the fact that the Damuda and Rajmahal floras of India shew affinities with those of almost every division of the Mesozoic era in Europe, and I would now draw attention to the fact that those species which are related to upper Secondary forms in Europe belong very largely to types which first appear in the Paleozoic beds of Australia. Foremost among these, of course, are *Glossopteris*, *Phyllothesa*, and *Vertebraria*; not known in Europe before Jurassic times, these were certainly living in Australia at the commencement of the Carboniferous epoch. *Pecopteris*, *Thinnfeldia*, *Gangamopteris*, *Naggarathiopsis*

likewise are found in the Newcastle series of New South Wales, but in Europe only in Secondary beds. Allowing that some of these genera are purely artificial, and that the species grouped under them may not really be allied in every case, it is on the other hand probable that some forms placed under distinct genera should properly be united with some of those grouped under the genera above mentioned, and, making the most liberal deduction for the value or want of value of negative evidence, I think that there is still a very considerable weight of probability, on this count alone, in favour of a newer type of vegetation having originated in Australia in Palæozoic times and in the Permian period commenced to spread over the rest of the world.

The explanation seems to be that, on the advent of the Glacial period, the flora, which had supplanted the older types in Australia, was driven towards the Equator. As the climate ameliorated, it did not again retreat towards Australia, either because its place was taken by newer species, or, more probably, because, owing to changes in the distribution of land and water, it could no longer do so, but to the north—or what for convenience we may provisionally call the north,—of the Equator it lived on in what is now India and, gradually spreading over the hemisphere, produced a profound modification in the pre-existing floras of what we now know as the Old World.

The flora of the Wianamatta beds, as I have explained, shews a certain relationship with that of the Damudas, but none with that of the Newcastle beds as far as species go, of the genera, however, three out of the six, or, if we include the Hawksbury beds, four out of seven are also found in the Newcastle beds. The beds newer than the Wianamattas have yielded a flora consisting of nine species belonging to seven genera, of which, if we except the *Phyllothea australis*, only one species is allied to an Indian form, viz, *Pecopteris australis*, Morr. allied to *P. indica*, Oldh. and Morr. from the Rajmahals. We have here a distinct decline in the closeness of relationship between the Indian and Australian floras, and, though, of course, this might be due to the imperfection of the record, the probabilities are against its being entirely due to that cause, and we may safely conclude that some barrier separated the two areas, by which the floras of India and Australia were kept apart and followed separate and consequently diverging lines of descent.

Turning now for a while to South Africa, I must commence by declaring it as my opinion that the relationships between the Indian and African floras of the periods I am discussing are with difficulty explicable, unless it is granted that there was in those days a continent, or at any rate a continuous chain of islands, stretching from South Africa towards India. I am aware that Mr. A. R. Wallace has declared such to be uncalled for and

impossible to grant,\* and I am ready to admit that the facts of distribution of animals as detailed by him are conclusive against the possibility of such a distribution of land and water, at any rate since the Miocene period. But there is no reason to suppose that the present distribution of plants or animals can throw any light on the distribution of land and water in late Palæozoic and early Secondary times. On the other hand, in favour of the land connection, I claim, *firstly*, that the relationship between the fauna and flora of the Damudas on the one hand and the Karoo beds on the other is far more real and close than the mere 'similarity of animal and vegetable productions' to which Mr. Wallace seems to have considered it to be confined; *secondly*, that this relationship of the two floras continued into the Uitenhage and Rajmahal series, which could hardly have been the case had the two areas been as separated then as now; and, *thirdly*, that the very peculiar relationships and differences between the cretaceous faunas of Central and Southern India on the one hand and Arabia and South Africa on the other are such as imperatively to demand the existence of a continuous barrier of dry land stretching between India and Africa. It is needless to expatiate further on this point, for, if such a barrier existed during the Cretaceous period, any argument against its possibility derived from the doctrine of the permanence of continents must fall to the ground, and there remains no reason why, if on independent grounds its existence is shewn to be probable, such a modification as I require may not have existed at the commencement of the Secondary period. That, during the deposition of the Damudas, there was continuous land communication with South Africa I do not suppose, for the very remarkable reptilian fauna, which, like the recent marsupial fauna of Australia, mimicked many of the higher mammalia, points rather to some isolated continental island which was connected with India, as Australia now is with Asia, by a chain of large islands separated by narrow straits, across which the spores of ferns and the seeds of plants could be wafted, but which were impassable to terrestrial reptiles.

But even a land connection of this sort would probably be inadequate by itself to account for the close relationship which the small fragment preserved to us of the flora of the Uitenhage period shews to that of the Rajmahals. For it is at least highly probable that the heat of the Equator would be as effectual a barrier as a broad sea, and, if the floras of India and Africa had pursued independent courses of development for a period sufficient for the dying out of every species and almost every genus, and for a change in the facies of the flora from one composed mainly of ferns to one composed mainly of cycads, it is inconceivable that the floras of the Uitenhage and Rajmahal series should exhibit the close

\* *Inland Life*, p. 286.

relationships they do. But this difficulty would not exist could we suppose that what are now South Africa and India then lay on the same side of the Equator; and thus the palæontology of these beds, as well as their petrology, points towards the conclusion that in early Secondary times the crust of the earth did not occupy the same position with respect to the axis of rotation as it now does.

That none of these arguments are conclusive by themselves I admit; I willingly admit that the floras preserved to us represent but a fraction of the species that lived when the beds that have yielded our fossils were being deposited, but the probability is vastly against only those species which were related to each other in the two countries being preserved, and we may, I think, safely argue from the small sample preserved to the larger bulk which is lost. In the same manner, I freely admit that the differences in the severity of climate may have been due to other causes besides difference of latitude, but on the average a colder climate indicates a higher latitude, and, when we find that, from whatever point we approach this matter, we are led towards the same conclusion, it seems to me that there is a very strong presumption in favour of its truth.

I fear this paper has already extended to too great a length for me to examine the arguments that have been put forward to prove that any change of latitude is physically impossible, but I cannot conclude without pointing out that what has been proved is that no conceivable elevation or depression of the earth's surface could produce an appreciable alteration in the axis of rotation of the earth as a whole. But, though the mathematical reasoning on which this conclusion is based may be unassailable, it has no bearing on the question of whether changes of latitude may not have taken place in the past, except on the assumption that the earth is rigid throughout, and that the crust has no power of sliding over the heated if solid core, an hypothesis which has been ably combated by the Rev. O. Fisher,\* and which I hold to be inconsistent with the known facts of stratigraphical geology. While, if the views put forward in this paper are true,—and there seems to me a very strong presumption in their favour,—the crust of the earth must in Mesozoic times have occupied a very different position with reference to the axis of rotation from that which it does at the present day.

As yet the only fact which has in any material degree attracted the attention of English geologists is the prevalence during the past of mild climates within what are now the Arctic regions; and hypotheses have been broached to account for this independent of an alteration of the position

\* *Physics of the Earth's Crust passim*; see particularly p. 184.

of the crust relative to the central core of the earth; but the more completely such an hypothesis may explain the absence of any trace of glaciation in the Palaeozoic, Secondary, or Tertiary rocks of the Arctic regions, to which Baron Nordenskiöld has drawn our attention, the more irreconcilable is it with the repeated traces of glacial action that are met with almost within the tropics. Yet the latter as urgently requires explanation as the former, and I have put these suggestions forward not from any conviction of their intrinsic truth, but because I feel that the rigid bonds within which mathematicians have sought to confine geologists must be largely and materially relaxed, because I feel that every addition to the growing pressure against these bonds is of some—even if but small—importance, but chiefly because I trust that I may be instrumental in drawing the attention of others with greater opportunities and greater abilities to the solution of this problem.

P. S.—Just a week before this paper was read Mr. W. T. Blanford, addressing the geological section of the British Association at Montreal, devoted the greater part of his address to the consideration of a subject to which he has before now referred, more particularly in the Records of the Geological Survey of India, and on which I have cursorily touched in the introductory part of this paper; I mean the uncertainty of palaeontological evidence in determining the exact correlation of widely separated beds. He also refers to a report on the Stormberg coal-fields by Mr. E. J. Dunne, which I have strangely overlooked: Mr. Dunne mentions the existence of three species of plants in the Stormberg beds identical with Australian species, an identification which, if correct, greatly diminishes, if it does not altogether annihilate, the value of my argument from the relationships between the African and Indian early Secondary floras, but this is of the less importance, as, owing to the known value or want of value of negative evidence in palaeontology, little value would in any case attach to an argument of this kind.

---



VI.—*Variations of Rainfall in Northern India during the Sunspot Period.*—By A. N. PEARSON, ESQ., *Officiating Meteorological Reporter for Western India.* Communicated by the PRESIDENT.

[Received October 6th;—Read November 6th, 1884.]

(With Pl. XI.)

Mr. S. A. Hill, in his paper on the "Variations of Rainfall in Northern India," published in the *Indian Meteorological Memoirs*, Vol. I, showed very clearly the opposition that exists between the variations of the winter and of the summer rainfall in Northern India during the sunspot period. For the purpose of bringing forward with greater clearness the main points of his investigation, he put the actual rainfall totals—which, as they stood, showed considerable apparent irregularities—through a simple process of smoothing such as is frequently adopted in dealing with statistical tables; and, by so doing, eliminated the apparent irregularities. But it appears to me that the unsmoothed results present points of interest over and above those that are presented by the smoothed results; that, in fact, the apparently irregular variations are regulated in a very definite manner.

In the table here given, I reproduce the general means of Mr. Hill's Tables II and IV, together with the smoothed results as he gave them in the text.

*Variations of the Rainfall for each Year of the Eleven Year Cycle  
in Percentages of the Local Means.*

| Year of the<br>Cycle. | Winter Rainfall. |           |             | Summer Rainfall. |           |             |
|-----------------------|------------------|-----------|-------------|------------------|-----------|-------------|
|                       | Unsmoothed.      | Smoothed. | Difference. | Unsmoothed.      | Smoothed. | Difference. |
| 1st                   | — 17.6           | — 17.1    | — 0.5       | + 0.8            | + 3.6     | — 2.8       |
| 2nd                   | — 4.6            | — 13.6    | + 9.0       | + 12.7           | + 7.4     | + 5.3       |
| 3rd                   | — 25.6           | — 18.8    | — 6.8       | + 3.3            | + 9.8     | — 6.5       |
| 4th                   | — 19.5           | — 20.4    | + 0.9       | + 19.8           | + 12.6    | + 7.2       |
| 5th                   | — 17.0           | — 7.8     | — 9.2       | + 7.4            | + 7.8     | — 0.4       |
| 6th                   | + 22.1           | + 23.1    | — 1.0       | — 3.5            | — 5.6     | + 2.1       |
| 7th                   | + 65.4           | + 35.6    | + 29.8      | — 22.7           | — 10.8    | — 11.9      |
| 8th                   | — 10.4           | + 15.7    | — 26.1      | + 5.6            | — 6.1     | + 11.7      |
| 9th                   | + 18.3           | + 10.2    | + 8.1       | — 21.0           | — 10.0    | — 11.0      |
| 10th                  | + 14.9           | + 4.9     | + 10.0      | — 3.6            | — 7.0     | + 3.4       |
| 11th                  | — 28.6           | — 14.9    | — 13.7      | + 0.2            | — 0.6     | + 0.8       |

The smoothed numbers of the above table are curved in the accompanying diagram (Pl. XI) in thick continuous lines, under the names "Winter Rainfall, A" and "Summer Rainfall, B." The figures so produced are identical with the curves given by Mr. Hill in his paper. The unsmoothed numbers of the above table are in the diagram superposed in dotted lines upon the smoothed curves. At the bottom of the diagram, I have reproduced the sunspot curve as given by Mr. Hill.

On inspecting the smoothed rainfall curves, it will be seen that the winter and the summer curve both agree in showing a single oscillation during the eleven years of the sunspot period; but they differ in the character of that oscillation, for, while the winter rainfall is at its maximum during the year of sunspot minimum, the summer rainfall on the contrary is then at a minimum. This is the main fact pointed out in the paper above quoted.

On inspecting the actual figures, however,—the unsmoothed numbers in the above table and the dotted curves A and B of the diagram—it will be seen that, besides this eleven yearly oscillation, both the winter and the summer rainfall show several variations of minor period such as geological Strata naturally suppose to be accidental; thus the winter rainfall has the introduction of distinct maxima, one in the 2nd year of the sunspot period, one in the 7th year, and one in the 9th and 10th, and minima in the 3rd, 8th, and 11th years; while the summer rainfall has maxima in the 2nd, 4th, and 8th years and minima in the 3rd, 7th, and 9th.

It is to these minor period oscillations that I wish in this short paper to call attention. And, in order that they may present themselves in a more convenient form for study, I have separated them from the eleven yearly oscillation by the simple method of subtracting the smoothed numbers in the above table from the unsmoothed. The differences are curved in the diagram under the name "Minor Oscillations of A and B," the winter oscillations being given in dot-and-dash lines, and the summer in simple dotted lines.

Confining attention to these "minor oscillations" curves, it will be noticed that, in those years which at the foot of the diagram are marked +, and which are years of maximum sunspot, the short period oscillations in the winter and the summer rainfall are of the same character, that is to say, that when there is more winter rain there is more summer rain, and when there is less of the one there is less of the other also. But it will be seen that, in those years which at the foot of the diagram are marked —, and which are years of minimum sunspot, the short period oscillations in the winter rainfall are of opposite character to those in the summer rainfall, that when there is more rain in the winter there

is less during the summer, and *vice versa*. Again, in those years which in the diagram are marked  $\pm$ , and which immediately precede the years of sunspot maximum and minimum, the order above pointed out obtains only in a slight degree; in other words, these are years of transition.

That these facts are purely the result of accident seems very unlikely, for they are supported by three other series of concurrent facts; which are as follow —

1st The *plus* years begin immediately after the sunspot maxima, and the *minus* years begin immediately at the sunspot minimum.

2nd There are more transition years during the slow descent of the sunspot curve than during its rapid ascent.

3rd The oscillations of both the winter and the summer rainfall are of greater amplitude during the *negative* years than during the *positive*.

With reference to the first of the above series of facts, it might be supposed that, as the *minus* years begin immediately at the sunspot minimum, so for perfect analogy the *plus* years should begin immediately at the sunspot maximum. But this is by no means necessary, for the slight delay in the coming in of the positive, apparently well with the slow descent of the sunspot curve as compared with the rapid ascent.

The main fact which I have pointed out in this means of Mr. [unclear], that the smaller variations of the winter rainfall are the same as those of the summer rainfall during years of maximum sunspot, and opposite in character during years of minimum sunspot,—if it can be established as a general rule, will be an important one; for it will indicate that, whatever be the cause which produces the general opposition in character between the eleven yearly variations of the winter and of the summer rainfalls, that cause operates chiefly during the years of minimum sunspot, and during three years of maximum sunspot it operates only in a very minor degree, and in two of those years (namely, the 1st and 2nd) it probably does not operate at all. By thus limiting the period during which the cause operates, a valuable point is gained, and a clue to a knowledge of the cause possibly afforded.

It is also interesting to notice that not only do the rules above indicated obtain *qualitatively*, but that there is also a near approach to a *quantitative* relation between the short period oscillations of the summer and the winter rainfall respectively. The nature of this relation in the years which I have denoted as *positive*, namely, in the 1st, 2nd, and 3rd years of the sunspot cycle, will be seen at once on inspecting the “*minus oscillations*” curve of the diagram. It will be observed that the oscillation which takes place in the two curves during those three years is not only the same in phase, but is nearly the same in amplitude. The

fact can be expressed numerically by taking the percentage rainfall as given in the "Difference" columns of the above table; when it will be seen that the winter rainfall of the 2nd year was 16·8 heavier than during the 1st and 3rd years taken together; while the summer rainfall was 14·6 heavier. The numbers 16·8 and 14·6, which according to this method are a measure of the excess of the winter and the summer rainfall respectively during the 2nd year, approach each other sufficiently to be noticeable.

The nature of the quantitative relation during the negative years, namely, the 7th, 8th, and 9th, will be best seen by an examination of the actual rainfall of those years. This, obtained from Mr. Hill's Tables I (A and B) and III (A and B), is as follows:—

| Year of the                 | Winter Rainfall. |         |         | Summer Rainfall. |         |         |
|-----------------------------|------------------|---------|---------|------------------|---------|---------|
|                             | Hills.           | Plains. | Mean.   | Hills.           | Plains. | Mean.   |
|                             | inches.          | inches. | inches. | inches.          | inches. | inches. |
| 1795                        | 17·95            | 6·30    | 12·12   | 41·81            | 26·36   | 34·08   |
| 1796                        | 9·58             | 3·23    | 6·40    | 54·01            | 34·63   | 44·32   |
| 1797                        | 16·55            | 4·59    | 10·57   | 47·13            | 27·03   | 37·08   |
| Average of the three years. |                  |         | 9·70    |                  |         | 38·49   |

Dealing only with the mean results, the variations in each year from the three years' average are in the case of the summer and winter rainfalls respectively as follows:—

|        | 7th year. | 8th year. | 9th year. |
|--------|-----------|-----------|-----------|
| Winter | + 2·42    | — 3·30    | + 0·87    |
| Summer | — 4·41    | + 5·83    | — 1·41    |

Now the point to be noticed is that

$$2·42 : 4·41 :: 3·30 : 5·83 :: 0·87 : 1·41,$$

or very nearly so; the winter figures to be in exact proportion, 2·83, 3·34, and 0·81; but the approach to exactness is sufficient to be striking, and to make one suspect that there has been more than chance at work in its production. If this proportion is established as a general rule, it will signify that, during the

at, and immediately succeeding, the sunspot minimum, an excess of 1 inch in the winter rainfall is accompanied by a defect of about 1.74 inches in the summer rainfall, and a defect of 1 inch during winter is accompanied by an excess of 1.74 inch during summer.

It is not my intention, for the present at least, to seek out the full meaning of these facts ; indeed, it is scarcely within my province to do so, as the investigation is already in more experienced hands than mine. But the facts forced themselves on my notice, and they seemed of sufficient importance to justify their publication.

---

VII.—Description of a new Lepidopterous Insect belonging to the *Heterocerous* Genus *Trabala*.—By F. MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY.

(Received August 26th ;—Read December 3rd, 1884.)

*TRABALA IBBORATA*, n. sp.

♂. Upperside dark olivaceous ochreous-yellow, sparsely speckled with dark purple-brown scales, which are most numerous disposed on the exterior border, and sinuously across the inner disc of both wings and also subbasally across the forewing, as well as on the posterior border of the forewing. Both wings with a discal transverse zigzag series of large lilacine-grey spots, which are also thickly speckled with the dark brown scales ; forewing also with the posterior border blotched with lilacine-gray, and with a prominent lilacine-gray spot, with dark brown speckled border, in the middle of the cell. Cilia entirely yellow.

underside slightly paler than the upperside ; both wings with the zigzag spots as above, the exterior borders less sparsely with whitish brown scales ; a slight brown-speckled sinuous discal band on the hindwing ; cell-spot indistinct. Ocelli brighter yellow, and tuft lilacine-white.

Length 3½ inches.

not only Mergui. Collected by Dr. J. Anderson, F. R. S.

VIII.—*Phyllothelys*, a remarkable Genus of Mantodea from the Oriental Region.—By J. WOOD-MASON, Deputy Superintendent, Indian Museum, Calcutta.

(With Plate XII.)

Genus PHYLLOTHELYS, W.-M.

P. A. S. B 1876, p. 176.—A. & M. N. H. 1876, 4th ser. vol. xviii, p. 507.—P. E. Soc. 1877, p. xviii.

♂. ♀. Vertex directed forwards and slightly upwards, strongly protuberant between the juxtocular lobes; the protuberance flat and triangular in front, behind convex and trefoil-shaped, being divided into three lobes, one large and median and two small, equal, and lateral; the former produced at the apex into a long, narrow, and very gradually tapering horn, which is expanded, together with the lobes themselves, in the middle line posteriorly and at the sides, into sharp foliaceous crests, and which may be rudimentary in the male; facial shield pentagonal, about as long as broad, marked with two blunt longitudinal lines, and with its basal angle slightly projecting. Eyes oval, tolerably prominent, not narrowed as in *Phyllocrania*. Pronotum long and slender, nearly five times as long as its parallel-sided anterior lobe, very gradually widening from its narrowest part just behind the dilatation, and equally gradually increasing in height, to its base, close to which it bears a prominent smooth tubercle, and where it is nearly as wide as at the distinct dilatation; prosternum slightly and decreasingly roof-shaped from the insertion of the forelegs backwards. Anterior coxae long and slender, when laid back not reaching to the base of prothorax, their apical lobes not divergent, but close together; tibiae half the length of the femora, with only the basal 5 or 6 of the spines of the outer edge curved towards the margin; femora with 3 spines on the outer edge and 4 on the disc; four posterior legs short; femora with genicular spines and with foliaceous lobes on the lower crest; tibiae with their apical half inflated latero-superiorly. Axillary and anal veins of tegmina running one immediately after the other into the internal ulnar vein, first ulnar vein branched; ulnar vein of wings 2-branched. Abdomen depressed, widening more (♀) or less (♂) from base to end of 5th somite, the remaining somites forming a triangular figure with more or less serrated sides; the dorsal arc of its 10th somite reniform, broader than long, subtriangular.

This interesting and curious form may be provisionally placed between the African genus *Phyllocrania* and the Oriental genus *Phyllothelys*.

1. *PHYLLOTHELYS WESTWOODI*, W.-M., Pl. XII, Figs. 1—2.

loc. supra cit.

♂. ♀. Rich dark or light umber-brown of the colour of bark and dead and rotten leaves.

♀. Vertex greatly protuberant; the protuberance divided into three lobes, two small and hemispherical, lateral and basal, and one large, the median lobe of the vertex, flat, smooth, and triangular in front, but convex in every direction behind, and rounded at the apex, from which it suddenly gives off a long, slender, and very gradually tapering almost linear horn; the protuberance is marked off in front from the rest of the head by a transverse groove which corresponds to an imaginary straight line drawn tangentially to the upper surface of the eyes, and the sides of its median lobe and of the horn into which this is prolonged are expanded into foliaceous crests, which are turned up or rather back at their outer edges and, being longitudinally wrinkled on their anterior surface, are hence sharply marked off from the perfectly smooth primitive horn; this is raised, in the middle line of its posterior face, into a thin, sharp, and prominent crest, which is continued a short distance on to the protuberance itself, and, owing to the forward curvature of the horn, as well as to its own decrease in height from the base upwards, hence has its free edge distinctly arched. In the male, the horn and its parts are reduced to a quite rudimentary condition and are folded up into a soft, flexible, and slightly asymmetrical conical process only about 1 millim. in length. Facial shield pentagonal, fully as long as broad, with two distant and incomplete longitudinal ridges on its disc and a blunt spiniform tubercle projecting from its basal angle. Eyes rather prominent; not nearly so narrow as in *Phyllocrania*.

Prothorax greatly elongated and slender, devoid of all traces of foliaceous expansions; prosternum roof-shaped decreasingly from the setting-on of the forelegs backwards and thickly speckled with darker; pronotum narrowing behind the dilatation and then widening again, concomitantly increasing in height, to the base, where it is as broad as at the dilatation, and where it bears in the middle line an elongate and slightly bilobed smooth tubercle; with its lateral margins finely denticulate and with a well-developed supracoxal dilatation; its anterior lobe parallel-sided, with a median dorsal ridge lodged in a shallow depression; its posterior lobe provided with a raised median longitudinal ridge decreasing from the base forwards and becoming stronger again at the dilatation, where, like the ridge on the anterior lobe with which it is in unbroken continuity, it is lodged in a shallow depression.

The forelegs are long and slender. The coxae are triquetrous and when laid back do not reach to the base of the prothorax; their inner face is coloured red-violet surmounted on the upper crest by yellowish marked with 10—13 minute elongate black spots lying at the bases of as many minute black spinules, between which are some very much more minute yellowish ones. The femora are very slightly sinuous above, but arched below; their outer face bears one distinct oblique bar and a minute mottling of a darker shade of brown than the ground-colour; their inner face is black, with the apex, a complete transverse bar nearer to the unguis groove than to the apex, and an oblong mark nearly midway between the unguis groove and the base on the upper half, all yellow; tibiae jet-black internally and below, armed on the inner edge with 14—15 and on the outer edge with 16 teeth, the basal five only of which are more recumbent than the rest and even they do not nearly touch the margin, or even one another; the intermediate and posterior legs are short; they are ridged as in *Phyllocrania*; the posterior of their lower crests bears a foliaceous lobe divided by an emargination into a very small proximal and a much larger distal portion with a rounded and nearly entire margin; the tibiae have no foliaceous crests, but, in lieu thereof, the proximal half swollen and thickened club-like laterodorsally, as in one or both of the same pairs of legs in the species of the tropical American genus *Acanthops* and its allies.

Organs of flight extending very little beyond the extremity of the abdomen, coloured. Tegmina coriaceous, opaque umber-brown anteriorly, posteriorly membranous and hyaline covered irregularly with brown-smoky spots, which tend in places to coalesce so as to form a coarse mottling; anal gusset reticulate, with the membranous meshes smoky and the net-work obsoletely lined with hyaline; the stigma elongate, polished. Wings with the anterior margin semiopaque umber-brown, the apex of the anterior area distinctly brown-spotted like the corresponding part of the tegmina; all the rest of the organs brown smoky-quartz-coloured, gradually increasing in intensity from the base to the outer margin, and tolerably distinctly lined with hyaline on both sides of the transverse veinlets.

Abdomen broad and depressed, gradually widening from its base to the end of the 4th somite, whence it widens with greater rapidity to the end of the 5th, the posterior angles of which are produced outwards; the rest of the abdomen forming a triangular mass the sides of which are slightly jagged owing to the production of the posterior angles of the dorsal arcs of the 6th and 7th somites; the terminal dorsal arc is crescent-shaped, longitudinally roof-shaped, and more than twice as broad as long.



The cerci are of the ordinary slender conical form and do not reach so far as the end of the ovipositor.

♂. Smaller and slenderer with the cephalic horn and its crests, as has been already stated, reduced to a rudimentary condition and all folded or shrivelled up together so as to form a soft and flexible projection no more than about a millimetre in length.

Organs of flight almost wholly membranous and hyaline. Tegmina with the marginal field semiopaque brown resolved into spots at the apex, with a few scattered groups of areolets in the discoidal area and the meshes of the anal gusset faintly smoky, and with some dark brown linear dashes on the longitudinal veins. Wings with their anterior margin pale brown spotted at the apex, the rest of these organs being very faintly iridescent-smoky, with obsolete double hyaline edgings to the transverse violets, from the base nearly to the outer margin, along which the smokiness and the longitudinal veins are alike darker, especially in the anterior area.

In the Tenasserim specimen of this sex the cephalic protuberance is more broadly rounded at the top and less produced, and the horn is more rudimentary (? in consequence of the specimen being a dried one), but there is no other apparent difference between it and the spirit-specimen from Assam described above, except perhaps in the tint (exaggerated in fig. 1) of the wings, which is slightly deeper in the latter.

Total length, ♀ 51, ♂ 40; height of head, from free margin of labrum to apex of horn, ♀ 14, ♂ 4·5, breadth of head between the eyes, ♀ 4·5, ♂ 3·75, length of horn, from a straight line drawn tangentially to the upper surface of the eyes, ♀ 10, ♂ 1·5; length of antennæ, ♀ 22, ♂ 22; length of pronotum, ♀ 22, ♂ 14·5, of its anterior lobe, ♀ 5, ♂ 3·3, of its posterior lobe, ♀ 17, ♂ 11·2, breadth of pronotum at supra-axial dilatation, ♀ 3·5, ♂ 2·75; length of fore-coxa ♀ 13, ♂ 9, femur, ♀ 14·5, ♂ 10, tibia, ♀ 8, ♂ 5·5, intermediate femur, ♀ 5·5, ♂ 4·5, tibia, ♀ 5, ♂ 4, posterior femur ♀ 7·5, ♂ 6, tibia ♀ 7, ♂ 5·5; length of tegmina ♀ 27, ♂ 27, breadth across middle ♀ 6·5, ♂ 6 millims.

HAB.—2 ♀ and 1 ♀ nymph, Sibságar, Assam (*S. H. Peal*), 1 ♂, Buxa, Bhutan (*Dr. Lewis Cameron*), and 1 ♂ Moolai, Upper Tenasserim (*Moti Bam*) in Indian Museum, Calcutta. A fine female is preserved in the British (Natural History) Museum, South Kensington, London.

## 2. *PHYLLOTHELYS PARADOXUM*, n. sp., Pl. XII, Fig. 3.

♂ nymph. Nearly allied to the preceding, which it closely resembles in the relative proportions of its parts and in every detail of colour and ornamentation, but from the same sex of which it differs in the possession of a fully developed cephalic horn and from the opposite sex

in the form of this horn, which is slenderer, much more thinly foliaceous, and jagged, instead of entire, on the edges, so as to resemble a very narrow pinnately-cleft leaf, the mid and lateral ribs of which are represented by the thick and hence opaque axes of the horn and its lateral processes. The fore tibiae have 16 teeth on the outer edge and 14 on the inner.

The only measurements of this immature insect that can usefully be given are:—length of pronotum 11, of fore femur 7, height of head, from free edge of labrum to top of horn, 7 millims.

HAB. Burmah.

This interesting animal was presented to me many years ago by my friend Mr. William Theobald of the Geological Survey of India.

#### EXPLANATION OF PLATE XII.

Fig. 1. *Phyllothelys westwoodi*, W.-M., ♂, with wings extended, nat. size; 1 a. the head, viewed from in front,  $\times 2$ ; 1 b. the left fore-leg, from the inside,  $\times 2$ .

Fig. 2. *Phyllothelys westwoodi*, ♀, with wings extended, nat. size; 2 a. the head, from behind,  $\times 2$ ; 2 b. the same, from in front,  $\times 2$ ; 2 c. the end of the abdomen, from above,  $\times 2$ ; 2 d. the posterior leg of right side, from in front,  $\times 2$ .

Fig. 3. *Phyllothelys paradoxum*, n. sp., ♂ nymph, the head, from in front,  $\times 3$ .



#### IX.—Notes on Indian Rhynchota, No. 1.—By E. T. ATKINSON, B. A.

Unless where expressly stated to be descriptions, the notes attached to each species are merely intended as aids to identification; and the measurements of specimens not in the Indian Museum have been converted into millimetres from the measurements of the several authors.

#### HOMOPTERA.

Family CICADEIDÆ, Westwood, Introd. Mod. Class. Ins. ii, 420 (1840).

*Stridulenta*, Stål, Hem. Afric. iv, p. 1 (1866).

.Ocelli three, placed on the disc of the vertex. Pronotum and mesonotum very large. Anterior coxæ prismatic, oblong, inserted in the anterior angles of the prostethium: intermediate and posterior coxæ briefly subconical, somewhat contiguous, remote from the sides of the body. Anterior femora incrassated, very often spinose, tibiae smooth. Tarsi 2—3 jointed. Abdomen in the males with an organ of sound on each side at the base.

## Genus POLYNEURA, Westwood.

Westwood, Arc. Ent. i, p. 92 (1842); Am. et Serv., Hist. Nat. Hém. p. 460 (1843); Stål, Hem. Afric. iv, p. 3 (1866).

## 1. POLYNEURA DUCALIS.

*Polyneura ducalis*, Westwood, Arc. Ent. i, p. 92, t. 24, f. 2 (1842); Jardine, Nat. Lib. t. 18, f. 1 (1843); Am. et Serv., Hist. Nat. Ins. Hém. p. 460 (1843); Walker, List. Hom. B. M., i, p. 2 (1850).

Easily recognised by its rich golden brown colour and the apical half of the tegmina being finely reticulated with hexagonal cells. Body long 35; exp. teg. 102 millims.

Reported from Assam, Sikkim, Nepál. The Indian Museum possesses specimens from Sikkim and Assam.

## Genus PÆCIOPSALTRIA, Stål.

Hem. Afric. iv, p. 2, (1866); Berl. Ent. Zeitschr. p. 168 (1866).

Allied to *Tettigades*, Am. et Serv. Thorax angulated on each side, anterior femora not spinose, metasternum elevated, the elevated part sulcate, produced and subsinuato-truncated in front.

## 2. PÆCIOPSALTRIA AFFINIS.

*Tettigonia affinis*, Fabr., Syst. Rhyn. p. 37 (1803).

*Cicada affinis*, Germar in Thon's Archiv. Ent. ii, fasc. 2, p. 1, 6, (1830); in Silbermann's Rev. Ent. ii, p. 79 (1834); Walker, List Hom. B. M. i, p. 3 (1850).

*Pæciopsaltria affinis*, Stål, Hem. Fabric. ii, p. 4 (1869).

Body long 23; exp. teg. 77 millims.

Reported from India, but no specimens appear in the British Museum list, and it would be well again to identify the locality of the specimen noted in Mus. Lund.

## Genus PLATYPLEURA, Amyot &amp; Serville.

Amyot et Serville, Hist. Nat. Ins. Hém. p. 465 (1845); Stål, Hem. Afric. iv, p. 2 (1866); Butler, Cist. Ent. i, p. 184 (1874).

## (a.) Species with yellow or tawny wings.

## 3. PLATYPLEURA PHALENOIDES.

*Platypleura phalenoidea*, Walker, List Hom. B. M. i, p. 4 (1850); Butler, Cist. Ent. p. 185 (1874).

*Platypleura interna*, Walker, l. c. iv, p. 1119 (1853), which differs in having the anal angle only (instead of the whole flap) of the wings black.

*Platypleura congre*, Stål, MS., is also possibly only a variety of this species.

Reported from Bengal, Assam, Silhat, N. India. A somewhat common species in Sikkim. The Indian Museum possesses specimens from Sibsagar, Sikkim, and Darjiling.

An examination of some fifty males shows some variations in individuals, even amongst those collected in the same locality. In the hyaline apical portion of the tegmina, the brown band is sometimes connected with the marginal row of spots, sometimes with the brown band across the middle part of the tegmina, and sometimes with neither. The hyaline spots in the radial and 3—4 ulnar areas vary much in size, and the metathoracic markings vary in size and distinctness. The venation, too, is not altogether uniform, and the colour of the thorax varies from green to brown.

♀. Body sordidly luteous above and below. Face moderately convex, transversely sulcated, with a longitudinal groove, luteous, vertex and pronotum furrowed, luteous. The mesonotal marks are represented by two almost obsolete short black lines on fore border and two faint black dots on hinder border. Abdomen black above, first three segments marginally luteous-pubescent; below, central portion tawny, thickly pubescent. Opercula small, somewhat rounded, wide apart. Legs colorous with body: posterior tibiae spinose, tarsi and claws piceous. Tegmina, markings as in ♂, but basal half suffused with deep fulvous. Wings as in ♂, but apical third alone brown, limbus hyaline, flaps fulvous. Length body,  $22\frac{1}{2}$ ; exp. tegm. 75; of one tegmen 34; breadth of pronotum 13 millims.

HAB. Sikkim, one specimen only in the Indian Museum.

#### 4. PLATYPLEURA ASSAMENSIS, n. sp.

Sordid green, face very slightly convex, transversely sulcated, with a longitudinal groove: a fascia extending from eye to eye through the base of the antennae, black. Rostrum extends to third abdominal segment, tip piceous. Markings above as in *P. phalaenoides*, Walker. Abdomen piceous, each abdominal segment with a slight marginal fulvous pubescence. Opercula very small, wide apart piceous in the ♀; close together, piceous and margined with slight tawny in the ♂. Basal half of tegmina, brown, with irregular pale markings: a hyaline spot in the third quarter of the radial area, a pale spot at the base of the radial area and the 4—5 ulnar areas. Apical half of the tegmina pale hyaline; a brown patch extending through the apical anastomoses of the 1—3 ulnar areas: an inner apical row of six brown spots, first two and last broadest, first two confluent, middle sagittate, last confluent with the dot on the limbus: apical veins ending in six small oblong brown spots, beyond which in the limbus are six minute dots. Wings marked as in *P. phalaenoides* with which it is closely allied, but the body is much less robust, and smaller; and there is a difference in the markings and colour of the tegmina. Length body,  $23\frac{1}{2}$ ; exp. tegm., 69; of single tegmen, 30; breadth of the pronotum 12, millims.

♂ is slightly smaller, tegmen, 27 millims.

HAB. Sibságar and Nága Hills: ♂ and ♀ in Indian Museum.

##### 5. *PLATYPLEURA NICOBARICA*, n. sp.

Light ochraceous, shining. Face moderately convex, transversely sulcated, with a median longitudinal groove, an interrupted fascia extending from eye to eye, and a patch on each side of the base of the rostrum and along the first joint thereof, black. The rostrum extends well beyond the posterior coxæ, tip black. Eyes dull castaneous, pilose behind. Vertex deeply grooved, the hollows, a small triangular patch below the ocelli, a narrow fascia from eye to eye through the ocelli, and a narrow short longitudinal line between the ocelli and eyes, black. Pronotum furrowed, with a single, longitudinal, narrow, short, black line in the middle of the anterior margin, lateral processes subtriangular and their external margins brown. The mesonotum with two triangular black spots, their bases resting on the anterior margin, and on each side a large distinct V-shaped mark, slightly interrupted on the inner side, and two small round spots near the posterior margin. Segments of abdomen black, margined with yellow, above and below, slightly pubescent. Legs ochraceous, extremities of tibiae and claws brown-black, posterior tibiae spinose. Opercula ochraceous, small, rounded, contiguous, having a black patch near the base of posterior coxæ. Tegmina, basal half tawny with irregular brown markings in the radial and 1—4 ulnar areas and one in the costal membrane. The upper third of the third ulnar area and the apical areas hyaline, with an almost obsolete series of minute dots at the end of each vein: wings ochraceous, apical third brown, with veins ochraceous, a discal streak to anal angle and two lines confluent at the inner angle, brown. Length body, 24: exp. tegmina,  $75\frac{1}{2}$  of single tegmen 33: breadth of the pronotum,  $14\frac{1}{2}$  millims.

HAB. Nicobar Islands: in Indian Museum.

##### 6. *PLATYPLEURA SPHINX*.

*Platypleura sphinx*, Walker, List. Hom. B. M. i, p. 13 (1850): Butler, Cist. Ent. p. 188 (1874).

Tegmina whitish, brownish-tawny towards the base and having elsewhere some irregular pale-brown marks which here and there include white spots. Body long 18; exp. teg. 43 millims.

Reported from N. Bengal, N. India.

##### 7. *PLATYPLEURA CELEBS*.

*Platypleura celebs*, Stål, Trans. Ent. Soc. 3rd Ser. i, p. 573 (1868): Butler, Cist. Ent. p. 189 (1874).

Allied to *Pæciolopsaltria capitata*, Olivier, (Enc. Méth. v, p. 754) in regard to size, broadness of apical limb, tegmina and wings. Body long 28: exp. teg. 68 millims. Reported from N. India.

#### 8. PLATYPLEURA ANDAMANA.

*Platypleura andamana*, Distant, Trans. Ent. Soc. p. 174 (1878).

This species was described from a specimen procured from the Andaman islands. Body long 22: exp. teg. 84 millims.

#### 9. PLATYPLEURA ROEPSTORFFII, n. sp.

♂. ♀. Brownish tawny. Face gamboge colour, moderately convex, transversely sulcated, with a brown longitudinal groove. Rostrum extending almost to the posterior margin of the first abdominal segment, tip brown. Legs brown above, tawny below; tibiae setose, posterior pair spinose. Eyes bright castaneous, moderately prominent, pilose behind. Second joint of antennae pale tawny. A fascia from eye to eye, through the base of the antennae and frons, and another through the ocelli, black. Pronotum grooved, with an obtuse-angled black mark on middle of posterior border; lateral processes subtriangular, anterior margin slightly brown. Mesonotum with two obconical spots extending backwards from anterior border and having between them a variable sagittate mark, two dots wide apart, near posterior border, and a very obscure mark situate on the outer side of each of the obconical spots, black. Abdominal sutures black, margined with luteous, pubescent; anal segment below, luteous. Opercula very small, subelliptical, wide apart in the ♂; contiguous, semi-rounded, in the ♀. Tegmina brown, opaque: basal third tinged with tawny, very apparent when stretched out; two spots in the radial area (the basal extending into the costal membrane) and one in the fourth ulnar area, black. A patch in the middle of the first ulnar area, extending into the third, and one near the base of the third ulnar area, extending into the fourth, pale brown. Apical area pale brown; veins adorned with oval marks, brown, with a centre of pale brown. External margin with a row of six subquadrangular brown spots, divided by oval pale brown spots. Wings fulvous tawny, disc and a band along the fore and external borders brown. Length of body,  $24\frac{1}{2}$ ; exp. tegm.  $76\frac{1}{2}$ ; of one tegmen, 34; breadth of pronotum, 12 millims.

Closely allied to *P. andamana*, Distant.

HAB. Andaman Islands. Several specimens are in the Indian Museum.

#### (b.) With black and white wings.

#### 10. PLATYPLEURA BASALBA.

*Oxypleura basalba*, Walker, List Hom. B. M. i, p. 26, (1850).

*Platypleura basalba*, Butler, Cist. Ent. i, p. 191 (1874).

Body long 19, exp. teg. 61 millims. Reported from N. Bengal.

## 11. PLATYPLEURA NOBILIS.

*Cicada nobilis*, Germar in Thon's Archiv. ii, fasc. 2, p. 9 (1880) ; in Silbermann's Rev. Ent. ii, pt. 2, p. 82, (1884).

*Cicada hemiptera*, Guérin, Voyage Bélanger Ind. Orient. p. 500 (1834).

*Platypleura semilucida*, Walker, List Hom. B. M. i. p. 20 (1850).

*Platypleura nobilis*, Butler, Cist. Ent. i, p. 191 (1874) ; Distant, J. A. S. B. xlviii, (2), p. 38 (1879).

Reported from Java, Singapore, and Tenasserim : there is a specimen in the Indian Museum from Tenasserim. As this is a typical species of the smaller members of this genus, I re-describe it, the original description being practically unobtainable.

Tawny. Face tawny, moderately convex, transversely sulcated with the furrows brown and a longitudinal groove broadly black. Rostrum extending to the fourth abdominal segment, tip piceous. Eyes dull castaneous, with a narrow black fascia, extending from anterior margin around the base of the antennæ. Vertex with a bright tawny fascia on anterior margin and two minute obconical black marks, extending from posterior margin on each side of the ocelli, obsolete in some. Pronotum tawny, furrowed, furrows black ; a line from the middle of the anterior border to the posterior border, black and quadrangularly expanded on the disc. Mesonotum fulvous brown, with two moderate obconical black spots, extending backward from the fore border, midway between which there is a discal line connected with a fascia on the hinder border also black. On the outer side of both the moderate obconical spots is a large obconical patch, black, and extending from the fore border almost to the hind border. The metanotum is bright tawny. The abdominal sutures are black, edged with fulvous, slightly pubescent. Below, the fulvous margins of the abdominal segments alone appear. Opercula tawny, brown at the base, rounded, small, wide apart. Legs tawny, anterior and middle femora spotted brown, posterior tibiæ spinose. Tegmina, basal third tawny, with some irregular lighter markings : a hyaline spot, at the apex of the radial area, just above a dark brown spot which extends into the costal membrane : a black spot in the ulnar space. Apical two-thirds of tegmina hyaline, with three minute brown spots on the apical anastomoses of the first and second ulnar areas, also a very minute brown spot on each side of the middle of the vein separating the second from the third apical area and the third from the fourth ; six minute brown spots on the limbus. Basal two-thirds of the wings brown, with a discal streak extending to the anal angle, tawny ; apical third, hyaline ; flaps tawny with a brown line on the suture. Length body 16 ; exp. teg. 46 ; length of one tegmen 24 ; breadth of pronotum 8 millims.

Variety, *a*.—Markings on face and pronotum more distinctly black. The markings on the basal third of the tegmina are more distinctly pale forming a band of five spots extending from the costal membrane through the ulnar areas. The brown spots in the hyaline apical portion broader, the internal apical row produced through the apical areas and the external apical row of dots duplicated. The tawny discal streak of the wings wanting, flaps grey hyaline. From Manipur, in Indian Museum. Allied to *Platypheura insignis*, Distant.

## 12. PLATYPHEURA INSIGNIS.

*Platypheura insignis*, Distant, J. A. S. B. xlviii (2), p. 39, t. 2, f., 2 (1879).

Allied to the preceding, but tegmina and wings very distinct, the opaque portion being much less than in that species. Body long 15; exp. teg. 45 millims. Reported from Tenasserim and Hindustan: a specimen from the former locality is in the Indian Museum.

(c.) *With black, white, and red wings.*

## 13. PLATYPHEURA OCTOGUTTATA.

*Tettigonia octoguttata*, Fabricius, Ent. Syst. Suppl. p. 515 (1798); Syst. Rhynch. p. 39 (1803); Coquebert, Ill. Ins. i, p. 34, t. 9, f., 1 (1790).

*Oxypleura sanguiflua*, Walker, List Hom. B. M. i, p. 24 (1850); Ins. Scand. Hom. p. 2 (1858).

*Poclopaltria octoguttata*, Stål, Berl. Ent. Zeitschr. x, p. 168 (1866) (re-described).

*Platypheura octoguttata*, Butler, Cist. Ent. i, p. 192 (1874).

Body long 27: exp. teg. 80 millims. Reported from the Panjab, N. India, N. Bengal, S. India. The Indian Museum possesses specimens from Bengal, Calcutta, and Sambhalpur in the Central Provinces.

## 14. PLATYPHEURA SUBRufa.

*Oxypleura subrufa*, Walker, List Hom. B. M. i, p. 25 (1850).

*Poclopaltria capitata*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866), who joins together '*subrufa*' and '*capitata*' Olivier (Enc. Méth. v, p. 754, t. 112, f. 10), the former an Indian and the latter a Ceylon species. They have been separated again by Butler (Cist. Ent. i, p. 192) and should remain separate.

*Platypheura subrufa*, Butler, Cist. Ent. i, p. 192 (1874).

Body long 27: exp. teg. 75 millims. Reported from Coromandel and India.

(d.) *With black, white, and brown wings.*

## 15. PLATYPHEURA BUFO.

*Oxypleura bufo*, Walker, List Hom. B. M. i p. 27 (1850).

*Platypheura bufo*, Butler, Cist. Ent. i, p. 195 (1874).

Body long 25: exp. teg. 81 millims. Reported from India.



16. *PLATYPLEURA CERVINA*.

*Platypleura cervina*, Walker, List Hom. B. M. i, p. 16 (1850) ♀; Butler, Cist. Ent. i, p. 198 (1874).

*Platypleura straminea*, Walker, l. c. p. 17, ♂.

Body long 17: exp. teg. 50 millims. Reported from N. Bengal.

Genus *TACUA*, Amyot & Serville

Am. & Serv., Hist. Nat. Ins. Hém., p. 461 (1843): Stål, Hem. Afric. iv, p. 3. (1866).

17. *TACUA SPECIOSA*.

*Tettigonia speciosa*, Illiger in Wied. Zool. Arch. ii, 145, t. 2; Fabricius, Syst. Rhyn. p. 33 (1803).

*Cicada indica*, Donovan, Ins. Ind. Hem., t. 2, f. 3, (1800).

*Cicada speciosa*, Blanchard, Hist. Nat. Ins. iii, 165; Hém. t. 9 (1840-41).

*Tacua speciosa*, Am. et Serv., Hist. Nat. Ins. Hém. p. 462 (1843); Walker, List Hom. B. M. i, p. 46 (1850). J. A. S. Zool. i. p. 141 (1857).

Body long 55 millims. Reported from Java, Bengal (Donovan).

Genus *TOSENA*, Amyot & Serville.

Am. & Serv., Hist. Nat. Ins. Hém. p. 462 (1843): Stål, Hem. Afric. iv, p. 3. (1866).

18. *TOSENA MELANOPTERA*.

*Tosena melanoptera*, White, A. & M. N. H. xvii, p. 331 (1846); Walker, List Hom. B. M. i, p. 40 (1850).

Body long 60: exp. teg. 142 millims. Reported from Silhat, N. India. The Indian Museum possesses specimens from Sibságar and Sikkim.

19. *TOSENA MEARESIANA*.

*Cicada mearesiana*, Westwood, Arc. Ent. i, p. 98, t. 25, f. 1 (1842).

*Tosena mearesiana*, Am. & Serv., Hist. Nat. Ins. Hém. p. 463 (1843); Walker, List Hom. B. M. i, p. 46 (1850).

Body long 44: exp. teg. 130 millims. Reported from N. India. The Indian Museum possesses specimens from Sikkim.

20. *TOSENA ALBATA*.

*Tosena albata*, Distant, Trans. Ent. Soc. Lond. 1878, p. 175.

Body long 59: exp. teg. 132 millims. Reported from N. India.

21. *TOSENA SPLENDIDA*.

*Tosena splendida*, Distant, Ent. Month. Mag. xv, p. 76 (1878).

♂. Body long 47: exp. teg. 124 millims. ♀. Body long 49: exp. teg. 127. Reported from Assam, Naga Hills, Khasiya Hills. The Indian Museum possesses ♂ and ♀ from the Lushai country.

## Genus HUECHYS, Amyot &amp; Serville.

Am. & Serv., Hist. Nat. Ins. Hém. p. 464 (1843); Stål, Hem. Afro. iv, p. 4 (1866).

## 22. HUECHYS PHILAMATA.

*Tettigonia philamata*, Fabricius, Syst. Rhyn. p. 42 (1803); Stoll, Cig. p. 53, t. 13, f. 62 (1788).

*Cicada philamata*, Germar in Thon's Archiv. ii, fasc. 2, p. 26 (1830); in Silbermann's Rev. Ent. ii, p. 75, n. 52 (1834); Burmeister, Handb. Ent. ii, (i) p. 180 (1835).

*Cicada sanguinea*, Guérin, Voyage La Favorite, v, p. 155 (1830); Mag. Zool. p. 75 (1830).

*Huechys philamata*, Am. & Serv., Hist. Nat. Ins. Hém. p. 465 (1843); Walker, List Hom. B. M. i. p. 251 (1850).

Guérin (l. c.) unites this species with the following and keeps *H. sanguinolenta*, Fabr., which he had not seen, distinct, but he is not followed in this arrangement by later writers.

Body above black with the frons, two quadrate patches on mesothorax, and abdomen sanguineous: tegmina brown, wings cindery-grey and subhyaline. Body long 22 millims.

Reported from Philippine Islands, N. Bengal, and Silhat. The Indian Museum possesses specimens from the Nāga Hills, N. India, and Tenasserim.

## 23. HUECHYS SANGUINEA.

*Cicada sanguinea*, De Géor, Ins. iii, 221, t. 33, f. 17 (1778); Gmolin Ed. Syst. Nat. i, 3, 2098 (1782); Westwood in Donovan's Ins. China, t. 16, f. 1 (1842).

*Tettigonia sanguinolenta*, Fabricius, Syst. Ent. p. 681 (1775); Spec. Ins. ii, p. 321 (1781); Mant. Ins. ii, p. 287 (1787); Ent. Syst. iv, p. 25 (1794); Syst. Rhyn. p. 43 (1803).

*Cicada sanguinolenta*, Olivier, Enc. Méth. v, p. 756 (1790); Germar in Thon's Archiv, ii, fasc. 2, p. 3 (1830), in Silbermann's Rev. Ent. ii, p. 75 (1834); Blanchard, Hist. Nat. Ins. iii, p. 165 (1840-41); Guérin, Voyage La Favorite, v, p. 155, t. 45, f. 1 (1839); Mag. Zool. p. 75, t. 237, f. 1 (1839).

*Huechys sanguinea*, Am. & Serv., Hist. Nat. Ins. Hém. p. 465 (1843); Walker, List Hom. B. M. i, p. 251 (1850); J. L. S. Zool. i, p. 84 (1856); *ibid.*, x, p. 96 (1867); Distant, J. A. S. B. xlviii, (2) p. 38 (1879).

Guérin separates '*sanguinolenta*, Fabricius' and unites '*philamata*' with '*sanguinea*'. *H. incarnata*, Germar, Silb. Rev. Ent. ii, p. 75, (1834), and Brullé Hist. Nat. Ins. Hém. ii, t. 3, f. 2, is probably only a variety of *H. sanguinea*.

Head, thorax, and feet black: frons, two great spots on the mesothorax, and abdomen sanguineous: tegmina black: wings fuscous. Body long 18; exp. teg. 41½ millims.

Reported from India, Singapore, China, and the Eastern Archipelago. Specimens exist in the Indian Museum from Sikkim, Sibsagar, Calcutta, and Tenasserim.

## 24. HUECHYS TESTACEA.

*Tettigonia testacea*, Fabricius, Mant. Ins. ii p. 267 (1787); Ent. Syst. iv, p. 24 (1794); Syst. Rhyn. p. 42 (1803); Stoll, Oig. p. 41, t. 8, f. 41 (1788).

*Cicada testacea*, Gmelin Ed. Syst. Nat. i, pt. 4, p. 2008 (1782); Olivier, Enc. Méth. v, p. 756, t. 113, f. 5 (1790); Germar in Thon's Archiv. ii, fasc. 2, p. 3, (1830); Guérin, Voyage La Favorite, v, p. 155 (1839); Mag. Zool. p. 78 (1839).

*Huechys testacea*, Walker, List Hom. B. M. i, p. 252 (1850).

The upper surface of the body without red marks: tegmina brown, only partly transparent: wings concolorous, veins black: abdomen sanguineous.

Reported from Coromandel.

## 25. HUECHYS PHENICURA.

*Cicada phenicura*, Germar in Hilbermann's Rev. Ent. ii, p. 76 (1834); Guérin, Icon. du Règne Animal, p. 78 (1830-34).

*Huechys phenicura*, Walker, List Hom. B. M. i, p. 252 (1850).

Black, entire frons, mesothorax, and abdomen sanguineous; tegmina and wings black; sometimes frons black in the middle and thorax with a black basal spot or band running through it, sides and small median spot red.

Reported from India, Sikkim.

## 26. HUECHYS TRANSVERSA.

*Huechys transversa*, Walker, List Hom. B. M. Suppl. p. 40 (1856).

Black: tegmina with costa and transverse veins red and a testaceous band. Body long 23: exp. teg. 62 millims.

Reported from Hindustan.

## 27. HUECHYS THORACICA.

*Huechys thoracica*, Distant, J. A. S. B. xlviii, (2), p. 39, t. II, f. 3 (1879).

Known by the red hour-glass-shaped fascia on pronotum. Body long 19: exp. teg. 43 millims.

Reported from Tenasserim and Hindustan.

## 28. HUECHYS TRABEATA.

*Cicada trabeata*, Germar in Thon's Archiv. ii, fasc. 2, p. 3 (1830); Guérin, Mag. Zool. p. 78 (1839).

*Huechys trabeata*, Walker, List Hom. B. M. i, p. 252 (1850).

Body ferruginous, tegmina and wings fuscous with ferruginous veins. Body long, 20½ millims; tegmina broken at the ends.

Reported from Java.

There is a specimen in the Indian Museum, locality unknown.

## Genus SCIEROPTERA, Stål.

Hem. Afric. iv, p. 4 (1866).

Allied to *Græna*: ulnar veins contiguous at the base or united for a short distance; head scarcely narrower than the base of the thorax; anterior femora incrassated, spinose beneath.

## 29. SCIEROPTERA CROCEA.

*Oicada crocea*, Guérin in Voyage La Favorite, v, p. 159, t. 45, f. 3 (1829); Mag. Zool. p. 79, pl. ix, t. 237, f. 3 (1839); in Voyage La Coquille, Zool. ii (2), p. 183 (1830).

*Huechys crocea*, Walker, List Hom. B. M. i, p. 252 (1850).

*Scieroptera crocea*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866).

Yellow: thorax above with four reddish brown spots: abdomen saffron-red, more obsolete below. Feet yellow, tibiae and tarsi black. Tegmina and wings hyaline with yellow veins.

Reported from Bengal.

## 30. SCIEROPTERA SPLENDIDULA.

*Tettigonia splendidula*, Fabricius, Syst. Ent. p. 681 (1774); Spec. Ins. ii, p. 321 (1781); Mant. Ins. ii, p. 267 (1787); Ent. Syst. iv, p. 25 (1794); Syst. Rhyn. p. 42 (1803).

*Oicada splendidula*, Gmolin Ed. Syst. Nat. i, pt. 4, p. 2098 (1782). Olivier, Enc. Méth., v, p. 756 (1790). Germar in Thon's Archiv, ii, fasc. 2, p. 45 (1830); Guérin, in Voyage La Favorite, v, p. 159 (1839); Mag. Zool. p. 79 (1839); Westwood in Donovan's Insects China, t. 16, f. 4 (1842).

*Huechys splendidula*, Walker, List Hom. B. M. i, p. 252 (1850).

*Scieroptera splendidula*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866); Distant, J. A. S. B. xlviii (2), p. 38 (1879).

Yellow; thorax above with four large blackish rounded spots. Tegmina golden brown: anterior tibiae red, femora black: posterior femora red: abdomen sanguineous. Body long 17: length of one teg.  $19\frac{1}{2}$  millims.

Reported from N. India, Silhat, Tenasserim. The Indian Museum possesses specimens from Tenasserim, Arakan, and the Khasiya Hills.

## 31. SCIEROPTERA FUMIGATA.

*Huechys fumigata*, Stål, Ofvers. Kong. Vet. Akad. Förh. p. 244 (1854); Walker, List Hom. B. M. Suppt. p. 314 (1859).

*Scieroptera fumigata*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866).

Head, thorax, and scutellum black; their lateral margins, a median patch on the thorax, and spot on the scutellum yellow: tegmina fuscovinaceous, costa and veins weakly yellow testaceous; wings weakly vinaceous hyaline, abdomen and femora testaceous, the former above blackish. Body long 12: exp. teg. 28 millims.

Reported from India.

## Genus GRAPTOTETTIX, Stål.

Hem. Afric. iv, p. 4 (1866).

Allied to *Gæana*: tegmina with ten apical cells: vertex twice as wide as the eyes: anterior femora spinose beneath; tibiae longer than femora.

## 32. GRAPTOTETTIX GUTTATUS.

*Graptotettix guttatus*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866).

Blackish with the frons, four oval spots on the thorax, two large spots on the scutellum, and the abdomen sordidly yellow: tegmina and wings fuscous. Body long 25: exp. teg. 67 millims.

Reported from the Himálaya. The Indian Museum has a specimen from Sikkim.

## Genus GÆANA, Amyot &amp; Serville.

Hist. Nat. Ins. Hém. p. 463 (1843).

## 33. GÆANA OCTONOTATA.

*Cicada octonotata*, Westwood, Arc. Ent. ii, p. 34, t. 57, f. 2, ♀ (1848).*Huechys octonotata*, Walker, List Hom. B. M. i, p. 253 (1850).

Easily recognised by the tegmina brown with four yellowish spots and the wings rosate. Body long 37: exp. teg. 61 millims.

Reported from Assam. The Indian Museum possesses specimens from Sikkim.

## 34. GÆANA DIVES.

*Tosena dives*, Westwood, Arc. Ent. i, p. 98, t. 25, f. 2 (1842): Am. et Serv. Hist. Nat. Ins. Hém. p. 464 (1843): Walker, List Hom. B. M. i, p. 46 (1850).

Black: tegmina with reddish veins and a median transverse, narrow whitish band: wings testaceous, apical part black. Body long 25: exp. teg. 75 millims.

Reported from Silhat. The Indian Museum possesses specimens from Sikkim.

## 35. GÆANA CONSOERS.

*Gæana consors*, White, Proc. Zool. Soc. 1850; Walker, List Hom. B. M. i, p. 253 (1850).

Close to *G. festiva*, but differing in the markings on the tegmina. Body long 29: exp. teg. 84 millims.

The Indian Museum possesses specimens from the Níga Hills and Samaguting in Assam. One specimen has the body above and below black without a single spot or mark except a testaceous tinge on the lower part of the face; and the markings on the tegmina are dark green.

36. *GEANA FESTIVA*.

*Tettigonia festiva*, Fabricius, Syst. Rhyn. p. 41 (1803).

*Oicada thalassina*, Percheron, Gen. Ins. (Hém.), t. 2 (1834) : Guérin, Voyage La Coquille, Ins. p. 188 (1838).

*Oicada percheronii*, Guérin, Icon. Règne Animal, p. 355 (1838).

*Geana consobrina*, White, Proc. Zool. Soc. 1850; Walker, List Hom. B. M. i, p. 254 (1850).

*Geana festiva*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866); Hem. Fabr. ii, p. 5 (1869).

Black: a testaceous band across the face from eye to eye and around each eye: four narrow longitudinal yellow lines on the thorax. Tegmina bluish green or greenish yellow, the radial area with a small and larger spot below, a median band, three confluent apical patches, and a broad apical limb, black: wings white or bluish, apical part black with a white or bluish spot on the disc. Body long 33: exp. teg. 80 millims.

Reported from Assam, Bengal.

The Indian Museum possesses specimens from Darjiling and Sikkim. Some of these have the tegmina green, others greenish yellow, and, in some, the wings have the basal portion and a discal spot bright testaceous not white or pale, the size and arrangement of the markings on the body and tegmina remaining exactly the same.

37. *GEANA MACULATA*.

*Tettigonia maculata*, Fabricius, Syst. Ent. App. p. 831 (1775); Spec. Ins. ii, p. 819 (1781); Mant. Ins. ii, p. 206 (1787); Ent. Syst. iv, p. 20 (1794); Syst. Rhyn. p. 37 (1803).

*Oicada maculata*, Drury, Ill. Nat. Hist. ii, p. 69, t. 37, f. 1 (1773); Gmelin, ed. Syst. Nat. i, pt. 4, p. 2100 (1782); Olivier, Enc. Méth. v, p. 760, t. 112, f. 4 (1790); Germar in Thon's Archiv. ii, fasc. 2, p. 12 (1830); in Silbermann's Rev. Ent. ii, p. 74 (1834).

*Geana maculata*, Am. et Serv., Hist. Nat. Ins. Hém. p. 464 (1843); Walker, List Hom. B. M. i, p. 253 (1850).

♀. Black shining: two yellow spots on vertex between the eyes, one below each eye: six on mesonotum, four in front, two behind. Tegmina black, with five spots, two basal (of which one within radial area is minute) and three larger subequal median spots, whitish yellow: a white dot in 1—3 ulnar and in all the apical areas except the last. Wings black, basal part sordidly white and a sub-apical row of five white dots. A form of the ♂ has, instead of the dots or spots in the ulnar and apical areas, broad smears of dirty white, and is also larger than the ordinary ♀. Body long 32: exp. teg. 92 millims, ♀: body long 40 exp. teg. 97 millims. , form last mentioned.

The Indian Museum possesses specimens from Sikkim, Khasiya Hills, Samaguting, and the Dhansiri Valley.

38. *GAMA SULPHUREA*.

*Cicada sulphurea*, Hope, in Royle's Ill. Bot. Him., Introd., p. liv, t. 10, f. 2 (1839).

*Cicada pulchella*, Westwood, Arc. Ent. ii, p. 34, t. 57, f. 1. (1843).

*Gaeanu sulphurea*, Walker, List Hom. B. M. i, p. 254 (1850).

Black; head, pronotum, and mesonotum spotted sulphureous: tegmina and wings sulphureous for the basal two-thirds; apical third blackish-fuscous: tegmina with a blackish-fuscous median band: abdomen beneath and on each side at the tip, spotted yellow. Body long 38: exp. teg. 90 millims.

Reported from Nepal and N. India.

The Indian Museum possesses specimens from Sikkim and N. India.

Genus *DUNDUBIA*, Am. & Serv.

Am. et Serv., Hist. Nat. Ins. Hém. p. 470 (1843); Stål, Hem. Afric. iv, p. 5 (1866).

Head triangular: frons large, very convex, transversely sulcated, with a longitudinal groove in the middle: pronotum not amplified on the lateral margins: cheeks without a tubercle: rostrum not or barely reaching the base of the posterior coxæ: opercula long, extending beyond the middle of the venter, very often to the last segment.

This and the remaining genera of this group have been so imperfectly worked out, and the synonymy is so defective, that it is impossible for any one in this country to do more than indicate the recorded species. Walker's work here is particularly untrustworthy, and his descriptions quite unintelligible.

39. *DUNDUBIA MANNIFERA*.

*Cicada mannifera*, Linnaeus, Mus. Ad. Fried. p. 84 (1754), excluding synonymy.

*Tettigonia vaginata*, Fabricius, Mant. Ins. ii, p. 286 (1787); Ent. Syst. iv, p. 18 (1794); Syst. Rhyn., p. 35 (1803).

*Cicada vaginata*, Gmelin Ed. Syst. Nat. i, pt. 4, p. 2099 (1788); Olivier, Enc. Méth. v, p. 748 (1790); Stoll, Cig. p. 38, t. 7, f. 35 (1788).

*Cicada virescens*, Olivier, Enc. Méth. v, p. 747 (1790) t. 110, f. 2; Walker, List Hom. B. M. i, p. 64 (1850).

*Dundubia vaginata*, Am. et Serv., Hist. Nat. Ins. Hém. p. 471 (1843); Walker, List Hom. B. M. i, p. 47, 1130, (1850); J. L. S. Zool. x, p. 84 (1867).

*Dundubia mannifera*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866); Distant, J. A. S. B. xlviii, (3), p. 38 (1879); Trans. Ent. Soc. p. 634 (1881).

Body pale yellow-olive or virescent, spotless; tegmina and wings hyaline, spotless, costa of the former black or brown; opercula almost as long as the abdomen, narrowed near the base, thence oval, rounded at the tip, testaceous or pale green. ♂. Body long 43: exp. teg. 110 millims.

Reported from Morty, Sumatra, Tenasserim, Assam.

The Indian Museum possesses specimens from Java, Tenasserim, and Sikkim.

40. DUNDUBIA MICRODON.

*Dundubia microdon*, Walker, List Hom. B. M. i, p. 55 (1850).

Body long, 34: exp. teg. 88 millims. Reported from N. India.

41. DUNDUBIA LATERALIS.

*Dundubia lateralis*, Walker, List Hom. B. M. i, p. 61 (1850).

Body long, 29: exp. teg. 87 millims. Reported from Silhat.

42. DUNDUBIA INTEMERATA.

*Dundubia intemerata*, Walker, J. L. S. Zool. i, p. 84 (1856).

Pale testaceous: tegmina and wings hyaline, spotless, the costa of the former tawny, veins green. Opercula acute, triangular, narrow, extending to fifth ventral segment. Body long 21: exp. teg. 72 millims.

Reported from Singapore.

The Indian Museum possesses specimens from Tenasserim, Dhansiri-valley, Sibságar, Nága Hills, Samaguting.

43. DUNDUBIA VIBRANS.

*Dundubia vibrans*, Walker, List Hom. B. M. i, p. 54 (1850): J. L. S. Zool. x, p. 84 (1867).

Body pale tawny, wings colourless, pale tawny at the base; apex of tegmen slightly clouded with brown. Body long 36: exp. teg. 92 millims.

Reported from Silhat.

44. DUNDUBIA NICOMACHE.

*Dundubia nicomache*, Walker, List Hom. B. M. i, p. 67 (1850).

Body long 22: exp. teg. 85 millims. Reported from N. India.

45. DUNDUBIA TIGRINA.

*Dundubia tigrina*, Walker, List Hom. B. M. i, 69 (1850).

Body long 23: exp. teg. 69 millims. Reported from Malabar. The Indian Museum possesses specimens from Assam?

46. DUNDUBIA MACULIPES.

*Dundubia maculipes*, Walker, List Hom. B. M. i, p. 70 (1850).

Body long 25: exp. teg. 71 millims. Reported from N. Bengal.



## 47. DUNDUBIA SAMIA.

*Dundubia samia*, Walker, List Hom. B. M. i, p. 77 (1850).

Body long 28: exp. teg 71 millims. Reported from N. India.

## 48. DUNDUBIA SINGULARIS.

*Dundubia singularis*, Walker, List Hom B M Suppt p 7 (1858).

Body long 19 exp teg 62 millims. Reported from India.

## 49 DUNDUBIA RADHA.

*Dundubia radha*, Distant, Trans Ent Soc p 634 (1881)

Allied to *D. mannifera*, Linn, from which it differs by the much broader head, attenuated apices of the opercula, and its much larger size. In superficial appearance, it bears a strong resemblance to the genus (*Usmopaltria* (Distant) Body long 53: exp. teg. 124 millims.

Reported from Madras Presidency and Mussooree.

## 50 DUNDUBIA TRIPURASURA

*Dundubia tripurasura*, Distant, Trans Ent Soc p 635 (1881).

This species is allied to *D. vibrans*, Walker, from which it structurally differs by the long and subtriangular opercula. The abdomen is also broader, the tegmina unspotted, and the sanguineous colour of the abdomen and opercula are also somewhat peculiar and distinct. (Distant) Body long 33: exp teg. 85 millims.

Reported from Assam.

## 51. DUNDUBIA NAGARASINGNA.

*Dundubia nagarasingna* Distant, Trans Ent. Soc p 635 (1881).

Distant writes:—'I am somewhat at a loss for a closely allied species with which to compare it, but its distinct colour and markings and shape and the length of the opercula should sufficiently distinguish it.' Body long 39: exp teg. 95 millims.

Reported from N. W. Burma.

## 52. DUNDUBIA IMMACULA.

*Dundubia immacula*, Walker, List Hom. B. M. i, p. 50 (1850).

Body fawn colour, wings whitish. Body long 40: exp. teg. 102 millims. Reported from Tenasserim.

## Genus MELANPALTA, Kol.

Melst. Ent. vii, p. 27 (1857).

## 53. MELAMPALTA VARIANS.

*Oleada varians*, Germar in Silbermann's Rev. Ent. ii, p. 59 (1834).

*Dundubia varians*, Walker, List Hom. B. M. i, p. 48 (1850); iv, p. 1120 (1852): Suppt. p. 6 (1858).

*Dundubia chlorogaster*, Walker (nec Boisduval), l. c. p. 47, ♀.

*Melampalta varians*, Stål, A. S. E. F. (4 Sér.) i. p. 619 (1862).

Reported from Silhat.

## Genus COSMOPSALTRIA, Stål.

Hem. Afric. iv, p. 5 (1866).

In Ofvers. Kong. Vet. Aka. Förh. p. 708 (1870), Stål distributes this genus amongst three subgenera:—*Platylomia* to which *C. flavida*, Guérin, belongs; *Cosmopsaltria* to which *C. spinosa*, Fabr., belongs; and *Diceropygia* to which *C. oblecta*, Fabr., belongs. *Cosmopsaltria* is closely allied to *Dundubia*; cheeks without a tubercle; rostrum reaching the base or most often the apex of the posterior coxæ; opercula long, extending beyond the middle of the venter.

## 54. COSMOPSALTRIA OBLECTA.

*Tettigonia oblecta*, Fabricius, Syst. Rhyn. p. 35 (1808).

*Oicada oblecta*, Germar, in Thon's Archiv, ii, fasc. 2, p. 5 (1830).

*Dundubia oblecta*, Walker, List Hom. B. M. i, p. 47 (1850).

*Cosmopsaltria oblecta*, Stål, Hem. Fabr. 2, p. 4 (1869).

Reported from N. India, N. Bengal, Nepál and Assam. Body long 25: exp. teg. 85 millims.

Specimens in the Indian Museum are from Sikkim and Assam.

## 55. COSMOPSALTRIA SITA.

*Cosmopsaltria sita*, Distant, Trans. Ent. Soc. p. 636 (1881).

It is difficult to separate this and the two following species from the genus *Dundubia* except by the length of the rostrum. They also resemble the 'vibrans' group of that genus. Body long 24: exp. teg. 73 millims.

Reported from S. India or Bombay. (*Distant*).

## 56. COSMOPSALTRIA DURGA.

*Cosmopsaltria durga*, Distant, Trans. Ent. Soc. p. 637 (1881).

This species in size and markings (excluding the spotted tegmina) much resembles *Dundubia tripuraura*, Distant; the less produced frontal portion of the head and the length of the rostrum, however, place it in this genus (*Distant*). Body long 33: exp. teg. 98 millims.

Reported from Assam.

## 57. COSMOPSALTRIA ABDULLA.

*Cosmopsaltria abdulla*, Distant, Trans. Ent. Soc. p. 639 (1881).

This is a large and distinct species, near *C. doryca*, Boisd., from

which it differs by its large size, more spotted tegmina, and different size and structure of the opercula. Body long 46: exp. teg. 116—122 millims. Reported from Penang and Singapore.

## 58. COSMOPSALTRIA OOPAGA.

*Cosmopsaltria oopaga*, Distant, Trans Ent Soc. p. 641 (1881).

This species is also allied to *C. doryca*, Boisd., but the body is much broader, the tegmina are unspotted, and the shape of the opercula more like those of *C. abululla*, Distant. Body long 89: exp. teg. 96 millims.

Reported from Burma.

## 59. COSMOPSALTRIA SPINOSA.

*Tettigonia spinosa*, Fabricius, Mant Ins. ii, p. 266 (1787); Ent. Syst. iv, p. 17 (1794), Syst. Rhyn. p. 34 (1803)

*Cicada spinosa*, Olivier, Enc. Méth. v, p. 748 (1790)

*Dundubia spinosa*, Walker, List Hom. B. M. i, p. 47 (1850).

*Cosmopsaltria spinosa*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866); Offens. Kong. Vet. Akad. Förel. p. 708 (1870)

Varies much in size and coloration. Tegmina towards the apex of the veins sometimes immaculate and sometimes with fuscous spots.

Reported from India.

## 60. COSMOPSALTRIA FLAVIDA.

*Cicada flavida*, Guérin, Voyage Belanger in Ind. Orient. p. 408, t. 3, f. 1, (1834); Walker, List Hom. B. M. i, p. 118 (1850)

*Dundubia saturata*, Walker, List Hom. B. M. Suppl. p. 6 (1858).

*Cosmopsaltria flavida*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

Body long 45: exp. teg. 140 millims. Reported from Java and Sikkim.

## Genus LEPTOPSALTRIA, Stål.

Hem. Afric. iv, p. 5 (1866).

Allied to *Dundubia*, Am. et Serv.; cheeks with a tubercle near the apex; rostrum extending a little beyond the posterior coxae; opercula short: second and third segments of the abdomen in the ♂ with a lateral tubercle.

## 61. LEPTOPSALTRIA GUTTULARIS.

*Cicada guttularis*, Walker, List Hom. B. M. Suppl. p. 29 (1858), ♀.

*Leptopsaltria guttularis*, Stål, Hem. Ins. Philip. in Offens. Kong. Vet. Akad. Förel. p. 710 (1870), ♂.

Very like *L. tuberosa*, Sign., but differs in the opercula being more obtuse, apex much less obliquely truncated, exterior apical part more obtuse, less produced, ventral tubercles of the ♂ larger, black. Body long 13: exp. teg. 46 millims.

Reported from Burma.

There are several unnamed species of this genus in the Indian Museum.

#### Genus POMPONIA, Stål.

\* Hem. Afric. iv, p. 6 (1866).

Allied to *Cosmopsaltria*: opercula short, somewhat transverse: rostrum reaching at least to the base but most often to the apex of the posterior coxæ. Stål (Ofvers. K. V.-A. Förh. p. 710, 1870) separates the subgenera *Pomponia* and *Oncotympana*.

#### 62. POMPONIA URANIA.

*Dundubia urania*, Walker, List Hom. B. M. i, p. 64 (1850).

*Pomponia urania*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

Hind-scutcheon bright green; abdomen green. Body long 34: exp. teg. 83 millims.

Reported from Hindustan.

#### 63. POMPONIA BINDUSARA.

*Pomponia bindusara*, Distant, Trans. Ent. Soc. p. 642 (1881).

This species, above, resembles *Dundubia vibrans*, Walker, and *Cosmopsaltria nita*, Distant. Many of these Indian species belonging to the genera *Dundubia*, *Cosmopsaltria*, and *Pomponia* have a common facies in colour and markings which Distant thinks is probably due to mimetic resemblance, and which, in practice, renders their identification exceedingly difficult. Body long, 30: exp. teg. 87 millims.

Reported from Tenasserim.

#### 64. POMPONIA LINEARIS.

*Dundubia linearis*, Walker, List Hom. B. M. i, p. 48 (1850). Var., l. c. iv, p. 1120 (1852).

*Dundubia ramifera*, Walker, var., l. c. p. 53 (1850): J. L. S. Zool. x, p. 84 (1867).

*Dundubia cinctimanus*, Walker, List l. c., p. 49 and Suppt. p. 6 (1856): J. L. S. Zool. x, p. 84 (1867).

*Pomponia linearis*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

Body tawny. Body long 46: exp. teg. 118 millims.

Reported from Silhat.

The Indian Museum possesses a specimen from Assam.

#### 65. POMPONIA KAMA.

*Pomponia kama*, Distant, Trans. Ent. Soc. p. 643 (1881).

Allied to *P. transversa*, Walker, but much smaller, abdomen narrowed and more linear, head broader in comparison with pronotum and colour different. Body long 18: exp. teg. 66 millims.

Reported from N. India, Darjiling.

## 66 POMPONIA MADHAVA.

*Pomponia madhava*, Distant, Trans Ent Soc p 644 (1881)

Allied to *P. tigroides*, Walker, from which it differs by its being pale greenish and unicolorous, the tegmina broader, with the costal margin irregularly curved and not deflexed at the termination of the radial veins, and also in having both the second and third abdominal segments beneath rounded, produced and pointed anteriorly. Body long 22: exp. teg. 55 millims

Reported from Assam

## 67 POMPONIA IMPERATORIA

*Cicada imperatoria*, Westwood, Arc Ent u, p 14, t 51, (1843) Walker, Last Hom b M i p 47 J L S Zool i p 83 (1856) ibid x, p 84 (1867)

*Pomponia imperatoria* Stål Berl Ent Zeitschr x, p 171 (1866)

A very large species, yellow luteous, body long 88, exp. teg. 209 millims

Reported from Nepal

## 68 POMPONIA TIGROIDES

*Pomponia tigroides*, Distant, J A S B xlviii (2), p 38 (1879).

The Indian Museum possesses a specimen from Tenasserim.

## Genus EMATHIA, Stål

Hem. Afric iv, p 8 (1866)

Inner ulnar area of tegmina not widened towards the apex; apical cells one and two extending equally far forward, thorax widened at the base. tympana chiefly exposed, opercula short. anterior femora spinose.

## 69 EMATHIA AGROTA

*Emathia agrota*, Stål, Berl Ent Zeitschr x, p 172 (1866).

Body long 20: exp. teg. 50 millims. Reported from Bombay.

## Genus CICADA, Linn.

Linnaeus, Syst Nat i, p 704 (1766) Stål, Rio Jan. Hem. ii, p. 19 (1868) Overseas K. V. A. Föhr. p 714 (1870).

## 70. CICADA SUBTINCTA.

*Cicada subtincta*, Walker, Last B M i, p 147 (1850).

Body long 32: exp. teg. 105 millims. Reported from Silhat.

## 71. CICADA ANNA.

*Cicada anna*, Walker, l. c., p. 207 (1850).

Body long 13: exp. teg. 40 millims. Reported from N. Bengal.

72. *CICADA AURATA*.

*Cicada aurata*, Walker, l. c., p. 215 (1850).

Body long 17: exp. teg. 42 millims. Reported from Assam.

73. *CICADA SUBVITTA*.

*Cicada subvitta*, Walker, l. c., p. 222 (1850).

Body long 16: exp. teg. 38 millims. Reported from N. India.

74. *CICADA FERRUGINEA*.

*Cicada ferruginea*, Olivier, Enc Méth v, p 750, t 112, f 1 (1790); Stoll, Cig. p. 65, t. 16, f. 86 (1788); Walker, List Hom. B. M. i, p 117 (1850).

Reported from India.

75. *CICADA XANTES*.

*Cicada xantes*, Walker, List Hom. B. M. i, p 198 (1850).

Body, drums, and legs tawny: wings colourless, veins yellow. Body long 17: exp. teg. 48 millims.

Reported from N. India.

76. *CICADA MACULICOLLIS*.

*Cicada maculicollis*, Guérin, Voyage La Coquille, Zool., p. 183 (1830); Walker List Hom. B. M. Suppl., p. 28 (1858).

Body long 24: exp. teg. 65 millims. Reported from Bengal.

Genus *CRYPTOTYMPANA*, Stål.

A. S. E. F. (4 Sér.), i, p. 613 (1862).—Hem. Afric. iv, p. 6 (1866).

77. *CRYPTOTYMPANA RECTA*.

*Fidicina recta*, Walker, List Hom. B. M. i, p. 79 (1850) ♀.

*Cryptotympana recta*, Distant, J. A. S. B. xlviii (2), p. 40, t. ii, f. 4 (1879), ♂.

Body long 32: exp. teg. 95 millims. Reported from Silhat and Tenasserim.

The Indian Museum possesses a specimen from Tenasserim.

78. *CRYPTOTYMPANA VICINA*.

*Cicada vicina*, Signoret, Rev. Mag. Zool., p. 410, t. 10, f. 4 (1849).

*Fidicina vicina*, Walker, List Hom. B. M. i, p. 80 (1850).

*Cryptotympana vicina*, Stal, A. S. E. F. (4 Sér.) i. p. 613 (1862).

Reported from Silhat.

The Indian Museum possesses specimens from the Bhutan Dufars.

79. CRYPTOTYMPANA IMMACULATA.

*Oscada immaculata*, Olivier, Enc Méth v, p. 749, t. 112, f. 7 (1790); Stoll, Orig. p. 40, t. viii, f. 39 (1788) Signoret, Rev Mag Zool p. 410 (1849)  
*Fidicina immaculata*, Walker, List Hom B M i, p. 90 (1850); iv, p. 1121 (1852).  
*Cryptotympana immaculata*, Stål, A. S. E. F. 4 Sér. i. p. 613 (1862).

Reported from N Bengal

80. CRYPTOTYMPANA INTERMEDIA

*Oscada intermedia*, Signoret, Mag Rev Zool p. 406, t. 10, f. 2 (1849)  
*Fidicina intermedia*, Walker, List Hom B M i, p. 90 (1850)  
*Cryptotympana intermedia* Stål, A. S. E. F. 4 Sér. i. p. 618 (1862)

Abdomen reddish yellow with a blackish band on each segment:  
 allied to (*C. atrata*, Fabr)

Reported from Tenasserim

Genus FIDICINA, Amyot & Serville

Amyot et Serville, Hist Nat Ins Hom p. 472 (1843) Stål, Rio Jan Hom ii, p. 18 (1862), Ann Soc Ent Fr (1 ser) i, p. 614 (1861), Hem Afric. iv, p. 7 (1866), Distant, Biol Can Amer p. 16 (1881)

81. FIDICINA OPERCULATA

*Oscada operculata*, Carreno  
*Fidicina operculata*, Walker, List Hom B M i, p. 90 (1850)

Reported from N India

The Indian Museum possesses a specimen

82. FIDICINA CORVUS.

*Fidicina corvus*, Walker, List Hom B M i, p. 86 (1850).

Reported from Silhat Body long 29 · exp teg 113 millims.

The Indian Museum possesses a specimen of the ♀ from Silhat.

Genus TIBICEN, Latreille

Latreille, Fam. Nat p. 426 (1825) Stål, Hem Afric iv, p. 25 (1866)

83. TIBICEN AURENGZEBE.

*Tibicen aurengzebe*, Distant, Trans Ent Soc, p. 646 (1881).

Body long 18: exp. teg. 48 millims. Reported from Bombay Presidency.

84. TIBICEN APICALIS.

*Oscada apicalis*, Germar in Thon's Archiv, ii, fasc. 2, p. 8 (1830); in Silbermann's Rev. Ent. ii, p. 63 (1834); Walker, List Hom B. M. i, p. 161 (1850).

*Tibicen apicalis*, Stål, A. S. E. F. 4 Sér., i, p. 618 (1862).

Body long 18: exp. teg. 48 millims, ♀. Reported from N. India.

The Indian Museum possesses a specimen from Calcutta.

Genus *MOGANNIA*, Amyot & Serville

Amyot et Serville Hist Nat Ins Hém p 467 (1848) Stål, Hem Afric iv p 5 (1866)

85 *MOGANNIA ILLUSTRATA*

*Mogannia illustrata* Am et Serv, Hist Nat Ins Hém p 467, t 9 f 4 (1848), Walker, List Hom B M 1, p 248 (1850)

Body uniform ferruginous brown basal half of tegmina and a small semicircular patch on the tips, transparent yellow, a brown transverse band across the middle Body long, 12 millims

Reported from N India

86 *MOGANNIA RECTA*

*Mogannia recta* Walker, List Hom B M Suppl p 39 (1858)

Abdomen with a red band on the posterior border of each segment Body long, 12 millims

Reported from Hindustan

87 *MOGANNIA OBLIQUA*

*Mogannia obliqua*, Walker, List Hom B M Suppl p 39 (1858)

♀ green mostly reddish beneath abdomen reddish with a spot on each side near the base Pronotum and mesonotum with some testaceous marks Body long, 14 exp teg 41 millims

Reported from Hindustan

88. *MOGANNIA VENUSTISSIMA*

*Mogannia venustissima*, Stål, Ofvers Kong Vet Aka Forh p 154 (1865)

Cerulean or metallic black Tegmina with the veins at the base pale sanguineous, before the middle black, thence sordid straw-colour wings with the veins at the base sanguineous and thence piceous Body long, 16 exp teg 37—41 millims

Reported from E India

89 *MOGANNIA FUNEBRIS*

*Mogannia funebris*, Stål, Ofvers Kong, Vet Aka Forh p 155 (1865)

Aeneous black Tegmina, before the middle, black with the basal areola and a band towards the apex of the black part sordid lutescent ♀ Body long, 19 exp teg 46 millims

Reported from Silhat

90. *MOGANNIA INDICANS*

*Mogannia indicans*, Walker, List Hom B M 1 p 249 (1850)

♂ bright or dark red, ♀ black. Tegmina with a broad basal brown band, veins yellow. Body long 12—16: exp teg 35—40 millims



Genus *CHCERADODIS*, Serville.

A. Fore femora without a black blotch on the inner side.

1. *CHCERADODIS STRUMARIA*.

Madame Mérian, *Ins de Surinam*, 1726, tab 27, ♀ et nymph.

Roesel von Rosenhof, *Der monatlich herausgegebenen Insecten Belustigung*, Star Theil, 1749, Locust tab iii, fig 1 et 2, ♀ et nymph (copied from Mérian).

*Mantis strumaria*, Linn, *Syst Nat. Ins* t i, pt. ii, 1767, p 691, no. 18, ♀.

——— Fabr, *Ent. Syst* ii, 1793, p 18, no 21, ♀.

——— *cancellata*, Stoll, *Spectres et Mantes*, pl xi, fig 42, ♀ (non Fabr.).

*Chceradodis cancellata*, Serville, *Hist nat des Orthopt* 1839, p. 206, ♀ (non Fabr.)

——— *cancellata*, Saunders, *Mant Americ* p 19, ♂, ♀

——— *strumaria*, Wood-Mason, *J A S B* xlix, pt ii, p 82, 1880, ♀.

Madame Mérian was the first to figure a species of this genus. Her figures were named and described by Linnæus, whose description applies to the perfect female insect, his name having obviously been suggested by a fanciful resemblance of the swellings on the sides of the pronotum in the supposed nymph to series of scrofulous tumours (*strumæ*)



Fig 5, ♀

The accompanying outline drawing of the pronotum of a specimen when superposed upon the same part of Mérian's figure, accurately coincides therewith.

Stoll's figure 42 without doubt represents a specimen of the same species.

HAB Cayenne (♀, Serville), Surinam (♀, Mérian, Stoll; ♂ ♀, De Saunders).

B. Fore femora with a black blotch on the inner side.

(a.) The blotch on the lower half of the joint (American).

In the females of the following two species, the posterior angles of the pronotal expansions are broadly rounded and are not produced backwards beyond the level of the hinder end of the primitive pronotum.

## 2. CHCERADODIS RHOMBICOLLIS.

*Mantis rhombicollis*, Latr. in Voy. de Humb., Zool., Ins. p. 103, pl. 39, figs. 2, 3, ♂.

*Chceradodis peruviana*, Serville, Hist. nat. des Orthopt. 1839, p. 207, ♂.

———— *strumaria*, Stål, Syst. Mant., 1877, p. 15, ♂ ♀.

———— *rhombicollis*, Wood-Mason, l. c. p. 82 ♂ ♀ —De Borre, Liste des Mant. Mus. Roy. de Belg. 1883, p. 5, et Comptes-rendus Soc. Ent. Belg. Nov. 1883, ♀ et nymph fig.

The blotch commences, in both sexes, near the base of the femur, extends through the unguis groove nearly to the middle of the joint, and is there succeeded by a marginal row of black points in contact with the bases of alternate spines.

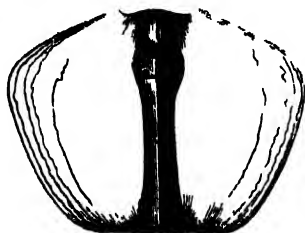


FIG 7, ♀

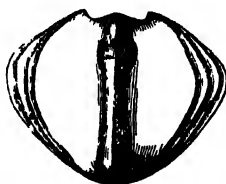


FIG 6, ♂

HAB. ♂ ♀, Guayaquil, in the collection of the British Museum; New Granada (♂ ♀, Stål); ♀ et nymph, Ecuador, in Mus. Roy. Belg.

## 3. CHCERADODIS SERVILLI.

Wood-Mason, l. c. p. 83, ♀ et nymph.

♀. Closely allied to the preceding, from which it differs in having the marginal field of the tegmina proportionately narrower, and in the smaller size, as well as in the different shape, of the femoral blotch, which

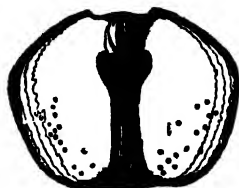


FIG 8, ♀.

is small and oval, commences just beyond the unguis groove, and is followed by a marginal row of small black points.

HAB. 2 ♀, Cache, Costa Rica, in the collection of Messrs. Godman and Salvin and of the Indian Museum; nymph (Fig. 3), Chiriqui, in the collection of the Indian Museum, Calcutta.

4 *CHORADODIS BRUNNEI*

Wood-Mason, J. A. S. B., 1882, xli, p. 21, ♀ et nymph

♀. Closely allied to *Ch. rhombicollis*, Latr., and *Ch. Servillei*, W.-M., differing from both in the size, shape, and position of the femoral blotch which is nearly three as long as broad, extends rather further in front of the ungual groove than it does behind it, and is followed by four black puncta arranged along the lower margin of the joint at the bases of alternate spines), and in having the posterior margin of the pronotum slight-



FIG. 1 ♀

ly convex instead of concave from the former in its much narrower and from the latter in its rather broader tegmina, and from the latter in the upper margin of its fore femora being coarsely granulated, and sinuous instead of straight, in which latter respect it approaches the former.

HAB. ♀ and nymph (Fig. 2), Santa Fe de Bogota, New Granada, in coll. Ind. Mus. Calcutta.

In the females of the next two species, and, in all probability, in those of *Ch. rhomboidea* also, the posterior angles of the pronotal lamellæ are rounded-angulate and produced backwards, so that the hinder end of the primitive pronotum projects in the bottom of an angular emargination.

5 *CHORADODIS LATICOLLIS*

*Choradodis laticollis*, Serville, Revue, p. 24, Hist. nat. des Orthopt. 1839, p. 208, pl. iv, fig. 2, ♀

— — — — — Saussure, Mant. Americ. p. 20, ♀

— — — — — strumaria, Id., ibid. p. 18, ♂

— — — — — laticollis, Stål, Syst. Mant. 1877, 17, ♀

— — — — — Wood-Mason, J. A. S. B. 1880, vol. xlix, pt. ii, p. 83, ♂ ♀

The blotch is situated, in both sexes, just beyond the ungual groove, is oblong-rhomboidal in shape, and is followed by two black points on the bases of alternate spines, there is a fuscous speck at the end of the stig-

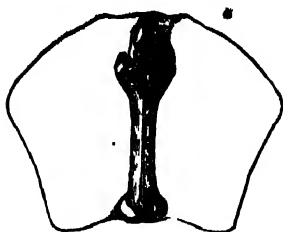


Fig. 11, ♀.



Fig. 10, ♂.

matal spot of the tegmina; and the antero-lateral margins of the pronotal lamellæ are arcuate or convex, especially in the female

HAB. 5 ♂, 5 ♀, Ecuador, in the collection of the Indian Museum, Calcutta; Peru (♀, Stål); Cayenne (♀, *Serville et Stål*); Surinam (♂, *Saussure*).

#### 6. *CHORADODIS STALII*.

Wood-Mason, l. c. p. 83, ♂ ♀.

Differs from the preceding in the shape of the blotch (which is pointed at both ends and commences in the ungual groove, and on either side of which the femur is pale luteous-yellow instead of being clouded with fuscous); in being without a fuscous spock at the distal end of the

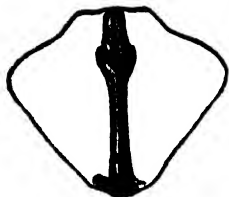


Fig. 13, ♂

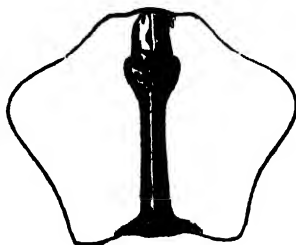


Fig. 12, ♀

stigma; in its shorter and differently shaped facial shield; and in having the antero-lateral margins sinuous-concave and the lateral angles of the pronotal expansions more broadly rounded off.

HAB. 1 ♂, 4 ♀, Ecuador, in the Museums of Calcutta and Oxford.

#### 7. *CHORADODIS RHOMBOIDEA*.

*Mantis rhomboides*, Stoll, *Spectres et Mantes*, pl. xi, fig. 45, ♂.

*Choradodis rhomboides*, Wood-Mason, l. c. p. 84, ♂.

A male insect from Pará, in the British Museum, agrees neither with *Saussure's* description (*loc. supra cit.* p. 18), nor with any of the speci-

mens in the Indian Museum; it more nearly approaches Stoll's figure, agreeing therewith in the points in which it differs from the former.

The blotch commences in the ungual groove, thence extending as far along the femur as in the preceding four species, but it is not followed by a marginal row of black points. The pronotal lamellæ have no posterior angles, their postero-lateral margins dwindling away to nothing posteriorly.

HAB. ♂, Pará, in the collection of the British Museum. A nymph, from Ega, in the same collection, probably also belongs to this species.

This species is nearest allied to *Ch. laticollis*.

(β) The blotch on the upper half of the joint (Indian).

#### 8. *CHARADODIS CANCELLATA*.

*Mantis cancellata*, Fabr. Ent. Syst. ii, 1793, p. 18

*Charadodis squilla*, Lucas, Ann. Ent. Soc. Fr. 5 sér. ii, 1872, p. 32, ♀.

——— Wood-Mason, l. c. p. 48 (ex parte).

Pronotum dissimilar in the sexes, being much less dilated in the male than in the female, its antero-lateral and postero-lateral margins not forming an angle at their junction in the female.

Femoral blotch narrower, confined to the foliaceous crest of the joint, and bordered below by a band of enamel-like bright emerald-green.

In the shape and extent of the pronotal expansions, the male of this species much resembles the same sex of *Charadodis rhomboidea*, differing, however, strikingly therefrom in its much shorter pronotum. The female approaches and differs from those of *Charadodis rhombicollis* and its allies in the same respects.

HAB. India (*Fabricius*) generally, from Ceylon, through Madras and Central India (♀ in coll. Hop. Oxon.), to the banks of the Killing River on the N. E. Frontier (nymph [Fig. 1] in coll. Ind. Mus. Calc.)

Obs. A specimen of this species in the British Museum is erroneously labelled "Brazil."

#### 9. *CHARADODIS SQUILLA*.

*Charadodis squilla*, Saussure, Mém. Orthopt. t. i, 3me fasc. p. 161, pl. iv, fig. 3, ♂ et nymph.

? ——— Lucas, Ann. Entom. Soc. Fr. 5 sér. t. ii, 1872, p. 32, ♀.

——— Wood-Mason, l. c. p. 84 (ex parte).

Pronotum similar in the sexes, its postero-lateral forming with its antero-lateral margin a distinct angle in both; that of the male differing from that of the female only in being rather less expanded, and consequently less convex, postero-laterally.

Femoral blotch broader, extending on to the primitive femur up to the inner end of the unequal groove and not bordered with green.



Fig 14, ♂



Fig 15 ♀

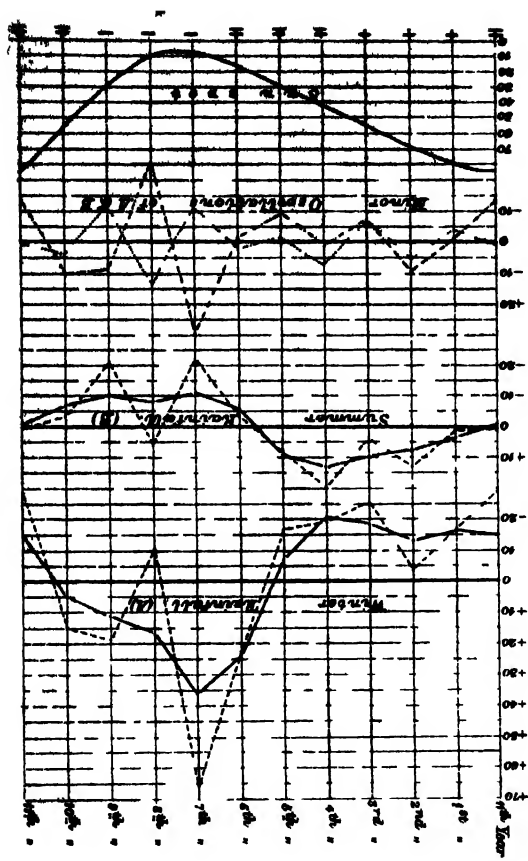
It is much more probable that the insect obtained by M. Jansen in the neighbourhood of Madras and described by Lucas as the opposite sex of De Saussure's species is a female of the preceding than of this species.

HAB. Ceylon, ♂ et nymph in Geneva Museum, ♂ ♀ and larvæ in Museums of Calcutta and Colombo.

I am indebted to the courtesy and liberality of the Trustees of the Colombo Museum for perfect insects and nymphs, and to Mr F. M. Mackwood for a nymph of this species.

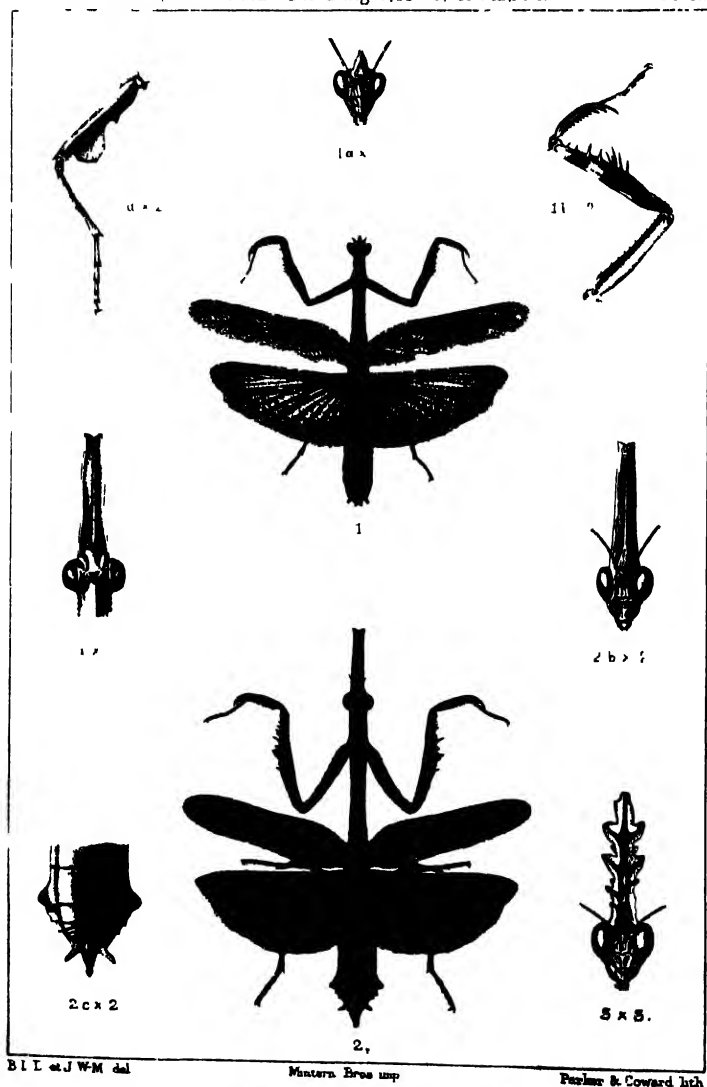
In Fig 14, the left lateral angle has been much too rounded off by the engraver; it should be like the right

Temperature in the Survey of India Office, Bangalore, Bangalore 1901





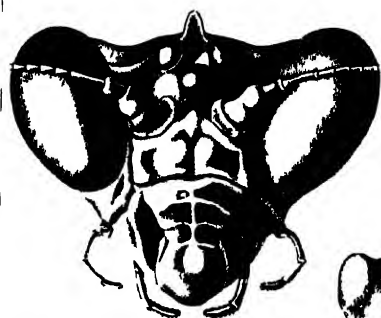




1-2. *Phyllothelys westwoodi*, ♂ ♀.

3. *Phyllothelys paradoxum*, ♂ nymph.





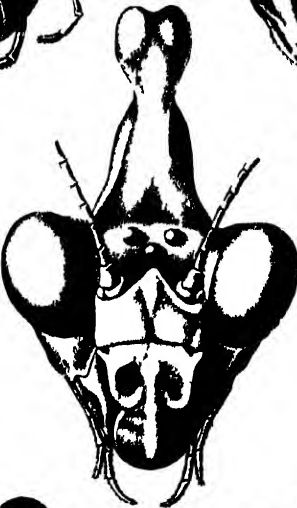
16



1x10



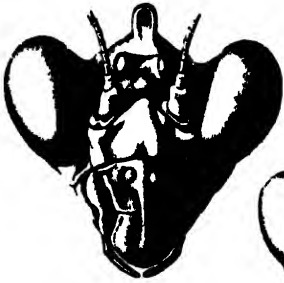
1x



1x10



5x2



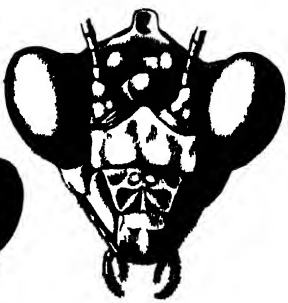
1x10



5x2



5x10

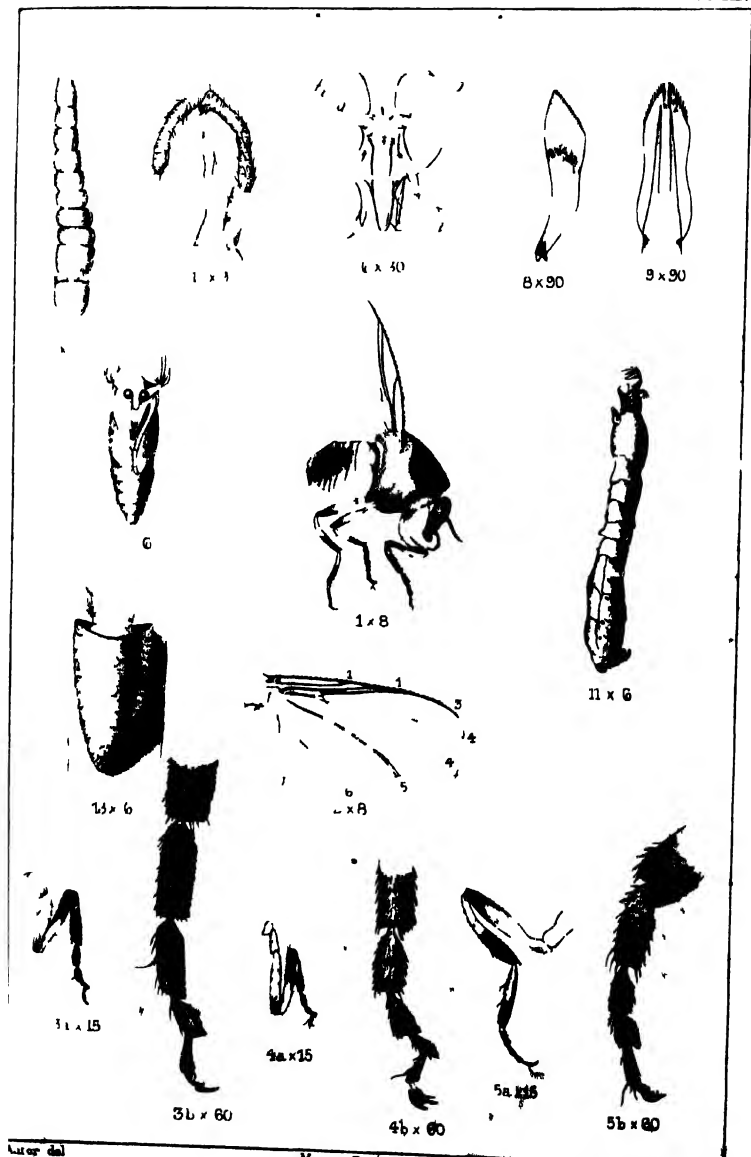


4x10



4x2





Lucas del.

Mentem Pressing  
SIMULIUM INDICUM

Parish & Conrad. Lith.




## CONTENTS

OF THE NATURAL HISTORY PART (PT. II.) OF THE  
JOURNAL OF THE ASIATIC SOCIETY OF BENGAL FOR 1883.

---

No 1, (issued October 24th, 1883). *Description of a new Species of the Rhopaloceros Genus Cyrestis from the Great Nicobar. (With Pl. I.)*—By LIONEL DE NICÉVILLE. *On the Measurement of Solar Radiation by means of the Black-bulb Thermometer in vacuo.*—By S. A. HUNT, B. Sc, Metl. Rep. to N W P and Oudh. *Notes of a Trip up the Dihing Basin to Dophá Pani, &c., January and February, 1882. (With Pls. II to VI)*—By S. E. PEAL. *On the recent Existence of Rhinoceros Indians in the North Western Provinces, and a Description of a Tracing of an Archaic Rock Painting from Mirzapur representing the Hunting of this Animal. (With Pls. VII and VIII.)*—By JOHN COCKBURN.

Nos. 2, 3 & 4, (issued March 6th, 1884). *On new and little-known Rhopalocera from the Indian Region. (With Pls. I, IX, & X.)*—By LIONEL DE NICÉVILLE. *Third List of Butterflies taken in Biddim in October, 1883, with Notes on Habits, &c.*—By LIONEL DE NICÉVILLE.



# CONTENTS.

|                                                                                                                                                                                                                                                                                                                                                                              | <i>Page</i> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>XVI.</b> — <i>The Landshells of Perak.</i> —By O. F. v. MÖLLENDORFF,<br>PH. D. Communicated by the NATURAL HISTORY SECRETARY .....                                                                                                                                                                                                                                        | 296         |
| <b>XVII.</b> — <i>On Solar Thermometer Observations at Allahabad.</i> —By<br>S. A. HILL, B Sc., Meteorological Reporter to the<br>Government of the N.-W. Provinces .....                                                                                                                                                                                                    | 310         |
| <b>XVIII.</b> — <i>On probable Changes in the Geography of the Punjab and<br/>its Rivers: an Historico-Geographical Study.</i> —By R. D.<br>OLDHAM, A. R. S. M., Deputy Superintendent, Geological<br>Survey of India (With a Map—Pl. XIX.),.....                                                                                                                            | 322         |
| <b>XIX.</b> — <i>List of the Lepidopterous Insects collected in Cachar by<br/>MR. J. WOOD-MASON, Part II, RHOPALOCERA.</i> —By J.<br>WOOD-MASON, Officiating Superintendent of the Indian<br>Museum, and Professor of Comparative Anatomy and<br>Zoology in the Medical College, Calcutta; and L. DE<br>NICÉVILLE, F. E. S. (With Pls. XV., XVI., XVII., &<br>XVIII.), ..... | 343         |
| <b>XX.</b> — <i>On some New Species of Ficus from New Guinea.</i> —By<br>GEORGE KING, M. B., LL. D., F. L. S., Superintendent,<br>Royal Botanic Garden, Calcutta .....                                                                                                                                                                                                       | 394         |
| <b>XXI.</b> — <i>Description of a new species of Phytophagous Coleoptera<br/>alleged to be destructive to the Dhan Crops in the Chittagong District.</i> —By JOSEPH S. BALY. Communicated by<br>the NATURAL HISTORY SECRETARY.....                                                                                                                                           | 412         |

Plates XII., XIII., & XIV., illustrative of papers by Mr. de Nicéville and Dr. George King published in the two preceding numbers.



# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.

---

### Part II.—NATURAL SCIENCE.

---

No. IV.—1886.

---

XVI.—*The Landshells of Perak.*—By O. F. VON MÖLLENDORFF, PH. D.  
*Communicated by the NATURAL HISTORY SECRETARY.*

[Received September 18th;—Read November 3rd, 1886.]

The following notes are based on a collection made by Deputy Surgeon-General R. Hungerford during a short visit to Perak, and on a number of shells received by the Indian Museum from Larut. I have thought it advisable to combine with the description of these a list of all species hitherto known from Perak. So far as I know, only the following papers have been published on the subject:—

H. CROSSE, *Mollusques nouveaux de Perak*. J. de Conch., xxvii, 1879, pp. 198—208 (5 sp.).

H. CROSSE, *Faune malacologique de Perak*. Ibid., pp. 336—340 (18 sp.).

H. H. GODWIN-AUSTEN and G. NEVILL, *Shells from Perak (and the Nicobar Islands)*. Proc. Zool. Soc. Lond., 1879, pp. 734—740 (9 sp.).

J. DE MORGAN, *Note sur quelques espèces nouvelles de mollusques terrestres recueillis dans la Péninsule Malaise*. Le Naturaliste, vii, 1885, No. 9, pp. 68—70 (16 sp.).

#### STREPTAXIDÆ.

##### 1. STREPTAXIS FLUSSANSIS, de Morgan.

de Morgan, Le Natur., vii, 1885, No. 9, p. 68.

"Heliciform, of whitish colour, spire regular, very flat, base ventrose, smooth, upper side transversely striate. Umbilicus very wide,

inner sides of all the whorls being visible, aperture triangular, slightly oblique, very irregular, having a tooth on the penultimate whorl and a groove ("sillon") in the upper part; 6 whorls, linear suture." Diam. maj. 7, alt. 3 mill.

HAB.—Mt. Tchékèl in the valley of the river Pluss.

This description is not sufficient to enable one to form an idea of the value of the species, which has to be compared with the several species described from the Malay peninsula.

## 2. *ENNEA PERAKENSIS*, Godwin-Austen & G. Nev.

Godwin-Austen & Nevill, P. Z. S., 1879, p. 735, t. lix, f. 2.

Dr. Townsend found two apparently immature specimens of an *Ennea* at Bukit Pondong, which the late Mr. G. Nevill considered to be full-grown and to be the type of a new subgenus of *Ennea*. Col. Godwin-Austen, however, deemed it best, considering only two specimens were found and that these were so similar in general form to immature specimens of *Ennea stenopylis*, Bens., from the Khasi Hills, not to found this new subgenus until further examples were obtained proving that the shell was a mature form. The results of Mr. Hungerford's investigations have justified Col. Godwin-Austen's caution. He found this *Ennea* in different stages of maturity, some entirely corresponding to the figure above quoted, but also some full-grown. The diagnosis has accordingly to be altered as follows:—

*Testa aperte perforata, cylindraco-claviformis, solidula, nitida, viridescenti-crystallina, anfr. 2 apicales fere glabrati, tertius confertim costulatus, reliqui 4½ costulis validis, planiusculis, subdistantibus, paulum arcuatis sculpti, ultimus penultimo angustior, circa umbilicum valde compressus, obtuse carinatus, antice substrangulatus, scrobiculatus. Apertura fere verticalis, rotundato-tetragona, peristoma latiuscule expansum, albolabiatum, margine externo ad insertionem subito attenuato, sinuato. Lamella parietalis valida usque ad marginem producta, callo dentiformi in palato opposito. Long. 4, diam. 2 mill.*

The other teeth which immature specimens show on the columella and in the palate, disappear in the full-grown shell. The analogy with *E. stenopylis*, Bens., pointed out by Godwin-Austen, exists also in full-grown specimens. *E. perakensis* is, however, a little longer, more cylindrical, the costulation more distant, and the ribs higher and less arcuate.

Our species as well as the following one belongs to the group of Indian and Chinese species for which the late Mr. Nevill has founded the subgenus *Martensia*. This name has, however, been pre-occupied by Semper (*Landsch-Philipp.*, I, 1870, p. 42) for a genus of the *Zonitida*,

type *Nanina mossambicensis*, Pfr. Although *Martensia*, Semp., has been considered a synonym of *Trochonanina*, Mouss., by some authors, doubts have been expressed more recently whether the Polynesian species of *Trochonanina* really belong to the same section as the East African oculate forms of *Nanina*. If not, *Martensia*, Semp., has to be retained for the latter group, and the section *Martensia*, Nev., has to be renamed.

### 3. *ENNEA HUNGERFORDIANA*, n. sp.

*T. aperte perforata, ovato-conica, sulcis validiusculis, subdistantibus verticalibus sculpta, viridescenti-crystallina; anfr. 6½ convexiusculi, ultimus angustior, basi valde compressus, substrangulatus, valde scrobiculatus, paululum ascendens. Apertura verticalis, parva, irregulariter ovalis, peristoma late expansum, margine externo ad insertionem subito attenuato, recedente, profunde sinuato. Lamella parietalis altissima, callum dentiformem marginis ceteri fere attingens et cum illo sinulum fere circulare formans. Long 3, diam 1½ mill.*

HAB.—Ad Buket Pondong, leg. cl. R. Hungerford.

Smaller and more ovate than the last. The greatest peculiarity of the species is the sinulus of the aperture. In most species of *Ennea*, the parietal lamella is opposed to a tooth or dentiform callosity in the outer margin of the peristome, which latter gets suddenly thinner from that place to the insertion and is more or less sinuate. Thus the lamella and tooth enclose a more or less circular orifice connected with the rest of the aperture by a small canal. In our species, the lamella is so much prolonged that it all but touches the tooth of the outer margin, and it looks as if the lamella really were the continuation of the peristome. The latter is, from the tooth upwards, not only suddenly attenuate, but also receding, so that the orifice or sinulus is hardly visible in front, but appears, when the shell is turned sideways, very much like a commencing tube. The only species in which I have seen a similar formation is *Ennea vara*, Bens., otherwise widely different from *E. hungerfordiana*.

## NANINIDÆ.

4. *ARIOPHANTA*, n. sp. (?), (prox. *N. (A.) INTERRUPTA*), G. Nevill, Handl. Moll. Ind. Mus., 1878, p. 20.

*Nuala Kangsa*, Perak; coll. Dr. Edmond Townsend.

No species of *Ariophanta* was found by Mr. Hungerford.

### 5. *REYSOTA*, sp.

Mr. Hungerford obtained a single specimen of a fine large *Nanina*, diam. 55, alt. 32 mill. It is greenish-brown with a narrow dark browa

band round the periphery and another broader one round the umbilicus, the periphery is obtusely angulate, the spiral rugose sculpture is coarser above, finer and more regular at the base; 6 moderately convex whorls form a little elevated spire. The nearest relation seems to be *Nanina pluto*, Pfr., from Cambodja, but it is probably a new species which I do not care to describe from a single example.

#### 6. HEMIPECTA CYMATIUM, Bens.

Perak, without distinct locality (*Hungerford*). The single specimen agrees fairly well with the figure and description of *Nanina cymatium*, known from Penang and Malacca.

#### 7. EUPLECTA BIJUGA, Stoliczka.

Stoliczka, J. A. S. B., xlii, pt. 2, 1873, p. 14, t. i, f. 4—7, t. ii, f. 16—18 (*Rotula*). *Helix bijuga*, Pfeiffer, Mon. Hel., vii, 1876, p. 108. *Nanina bijuga*, G. Nevill, Handl. Moll. Ind. Mus., 1878, p. 81. *Nanina (Rotula) bijuga*, Crosse, J. de Conch., xxvii, 1879, p. 336.

Buket Pondong (*Dr. Townsend, Hungerford*), originally described from Penang.

#### 8. MACROCHLAMYS, sp.

Mr. Hungerford found a few dead specimens at Buket Pondong which fairly agree with the form figured by Godwin-Austen (Land & Freshw. Moll. Ind., iv, 1883, p. 110, t. xxvi, f. 4) and mentioned by him as "*M. consepia*, Bens., small var. ?" from Tenasserim.

#### 9. MACROCHLAMYS, sp. *an nova?*

A single specimen from Buket Pondong. Small, 3 mill. long and 2 high, horn brown, well-polished, probably new.

There is besides another much smaller species of *Macrochlamys* and a species of *Microcystis*, which I have likewise left undescribed on account of the very scanty material.

#### 10. MICROCYSTINA TOWNSENDIANÆ, Godwin-Austen & G. Nevill.

Godwin-Austen & Nevill, P. Z. S., 1879, p. 736, t. lix, f. 1.

Buket Pondong (*Dr. Townsend, Hungerford*).

#### 11. KALIBELLA PERAKENSIS (G. Nevill), Godwin-Austen.

Godwin-Austen, Land & Freshw. Moll. Ind., i, 1882, p. 8, t. ii, f. 7.

Perak (*Dr. Townsend*), Buket Pondong (*Hungerford*).

#### 12. SITALA CARINIFERA, Stoliczka.

Stoliczka, J. A. S. B., xlii, pt. 2, 1873, p. 16, t. i, f. 8. Godwin-Austen, Land & Freshw. Moll. Ind., ii, 1883, p. 25.

Penang (*Stoliczka*). Mr. Hungerford found two badly preserved specimens at Bukit Pondong which agree entirely with *Stoliczka's* figure and description.

## HELICIDÆ.

### 13. *HELIX* (*TRACHIA*) *MALAYANA*, n. sp.

*T. latiuscula umbilicata, depressa, tenuis, pilis brevissimis in lineas regulares valde approximatus dispositis hirsuta, rufobrunnea; anfr. 5½ perconvexi sutura valde impressa juncti, spiram fere planam apice via prominulo efficientes, ultimus maximus, valde inflatus, antice breviter descendens, circa umbilicum subacute angulatus, apertura non valde obliqua, rotundato-lunaris, peristoma tenue, breviter expansum, via reflexiusculum, sinuosum, roseum* Diam. maj. 23, min. 18, alt. 14 mill.

HAB — In regione Perak, leg. cl. R. Hungerford.

I have little doubt that this is the form mentioned by Crosse (*J. de Conch.*, 1879, p. 336) as *H. (Planispira) breviseta*, Pfr., from Bukit Pondong, but judging from Pfeiffer's diagnosis—all I can compare at present—I do not believe that the Perak form can be combined with Pfeiffer's Siamese species. The latter is pale yellow ("pallide fulvida"), round the umbilicus only "subangulatus," the peristome is white, the dimensions are 22 mill. diam., 10½ mill. alt., there are only 5 whorls. There appears to be a great deal of affinity, and the comparison of the types may probably result in making the Perak form a variety of *H. breviseta*, Pfr., but for the present I prefer to give it a separate name.

14. A second species of *Trachia*, of which only a few dead examples were found at Bukit Pondong, is smaller, the whorls increase more regularly and the last one is not so prominently large; the spine is a little more prominent, the angle round the umbilicus much more obtuse. This is perhaps *Trachia penangensis*, Stol.

### 15. *HELIX PERAKENSIS*, Crosse.

Crosse, *J. de Conch.*, xxvii, 1879, p. 199, t. viii, f. 4 (*Geotrochus*).

Perak (*Dr. Townsend*), not found by Mr. Hungerford. I have some doubts about its really being a *Geotrochus*, a group which has not yet been observed in the Indian region. The figure gives the idea rather of *Satsuma* (or *Fruticotrochus*, Kob.), which group is widely spread in China, and might very well range into the Malay peninsula hitherto so little explored.

Mr. de Morgan's paper contains the following *Helix* :—

16. *HELIX SWETTENHAMI*, de Morgan.

de Morgan, l. c., p. 68.

Upper portion of the Kinta valley. 16 mill. wide, 10 high; flat, strongly keeled, peristome acute, columellar margin reflected to the umbilicus. May be a *Trochomorpha* or a *Plectotropis*.

17. *HELIX THIEROTI*, de Morgan.

de Morgan, l. c., p. 68.

"Gounong-Toheura," N. of Ipoh, Kinta valley.

Similar to the last, but discoid, reddish brown, diam. 15, alt. 4 mill. This is most probably a *Trochomorpha*.

18. *HELIX HARDOUINI*, de Morgan.

de Morgan, l. c., p. 68.

Kinta valley between Lahat and Ipoh.

Diam. 17 mill., alt. 8 mill., flat, strongly keeled, peristome expanded ("évasé.") Perhaps also a *Trochomorpha* or else a *Plectotropis*.

19. *HELIX LAHATENSIS*, de Morgan.

de Morgan, l. c., p. 68.

Between Lahat and Ipoh, Kinta valley.

Diam. 25 mill., alt. 14 mill., flat, slightly ("légèrement") umbilicated, strongly keeled, yellow ("blonde"), transparent, peristome acute, thin, columellar margin slightly reflected towards the umbilicus. Might also be a *Trochomorpha*.

## BULIMIDÆ.

20. *AMPHIDROMUS PERVERSUS*, Linn.

Perak (*Dr. Townsend*).

## STENOGYRIDÆ.

21. *STENOGYRA (OPREA) GRACILIS*, Hutton.

Buket Pondong (*Hungerford*).

22. *STENOGYRA (SUBULINA) TOHEHELENSIS*, de Morgan.

*T. elongate turrita, gracilis, tenuis, transversae densissime areolatum striatula, corneo-flavida, opaca; anfr. 12 planiusculi, spiram elongatam apice subacuto efficientes; apertura obliqua, angulate ovalis, peristoma acutum, margine dextro sinuoso; columella subincrassata, paulum arcuata, basi truncata, cum margine basali angulum retundatum formans.*

|      |     |       |    |       |        |     |
|------|-----|-------|----|-------|--------|-----|
| Long | 33½ | diam. | 6  | mill. | (anfr. | 12) |
| "    | 24½ | "     | 4½ | "     | ( "    | 10) |
| "    | 23  | "     | 5  | "     | ( "    | " ) |
| "    | 21  | "     | 4½ | "     | ( "    | 9½) |

1878. *Stenogyra* (*Opeas*) *terebialis* ?, Theobald (? n. sp.) G. Nevill, Handl. Moll Ind Mus, 1878, p. 166.

1879. *Stenogyra tochehelensis*, J. de Morgan, Le Naturaliste, vii, 1885, No. 3, p. 60.

HAB.—Mt. Tohéhèl prope flumen Pluss (*de Morgan*), Buket Pondong (*Dr. H. Townsend, Hungerford*).

I cannot but believe that the fine *Subulina* collected by Mr. Hungerford at Buket Pondong is the same which Mr. Nevill mentions from the same locality as a doubtful *H. (Opeas) terebralis*, Theob., or a n. sp. I have no figure of Theobald's species at my disposal—has it been figured at all? the Conchologia Indica does not give it—but if the species of the Shán States is really an *Opeas*, it cannot be identical with the Perak form, which decidedly belongs to *Subulina*. De Morgan's description of his *H. tochehelensis* is somewhat vague and apparently was taken from immature examples, but, as the dimensions given by him of a specimen having 10 whorls— $23 \times 5$  mill agree perfectly with those of some younger specimens in Mr. Hungerford's collection, I think the two forms of different Perak localities may be safely combined.

### 23. RHODINA PERAKENSIS, J. de Morgan.

de Morgan, l. c. 1885, p. 68.

Limestone rocks of Gounong Toheura near Ipoh, Kinta valley, under dead leaves.

Mr. de Morgan has founded a new genus for a curious *Stenogyra*-like shell, which he considers to be related to *Rhodesa*. It may be worth while to translate his description here:—"Shell cylindraceous, striate, dextrorse, numerous whorls, apex obtuse, last whorl much larger than the penultimate, aperture triangular, columellar margin reflected and very prominent ["saillant"], peristome continuous. Differs from the genus *Rhodesa* by the aperture "disposée en cornet" and by the want of a keel." I must confess that I fail to perceive any relation to *Rhodesa* from these remarks. The descriptive notes on the species are meagre also; it is cylindrical, fragile, horny yellow, has 10 regularly increasing whorls very regularly and distinctly striate, the suture is linear and well-marked, the aperture triangular, oblique, peristome thin, not reflected ("non déjeté"). Long. 25, diam. of last whorl 4½, long. of aperture 5, lat. 3 mill.

It is to be regretted that this apparently very interesting form has not been figured. Might it not be related to *Perrieria*, Tapp.-Can., of Borneo?

### CLAUSILIDÆ.

#### 24. *CLAUSILIA* (*PSEUDONENNIA*) *FILICOSTATA*, Stoliczka,

Stoliczka, J. A. S. B., xlii, pt. 2, 1873, p. 28, t. iii, f. 7, 8.

Var. *tenuicosta*, G. Nevill, Handl. Moll. Ind. Mus., 1878, p. 183. H. Crosse, J. de Conch., xxvii, 1879, p. 337.

Buket Pondong (*Dr. Townsend, Hungerford*).

The few badly preserved specimens which Mr. Hungerford found at Buket Pondong seem to justify Mr. Nevill's classification of the Perak form as a variety of the Penang *Olausilia filicostata*. The variety is longer, up to 24 mill., at the same time slenderer, the striation is much finer so that it could hardly be called costulate, there are fine spiral lines besides, 12 whorls instead of 10—11. It might even be separated as a species, especially if there are differences in the closing apparatus, the description of which is insufficient in Stoliczka's diagnosis. As I am unable to compare specimens of the typical *Olausilia filicostata*, I must leave this question undecided.

### PUPIDÆ.

#### 25. *HYPELOSTOMA BENSONIANUM*, W. Blanford.

W. Blanford, Contr. Ind. Mel., iv, 1863, p. 8. Pfeiffer, Mon. Hel., v, 1868, p. 437. Conch. Ind., t. viii, f. 2.

Of the three species of *Hypselostoma* hitherto described, *H. bensonianum* is the only one with which the form collected by Mr. Hungerford at Buket Pondong can be combined. Diagnosis and figure agree fairly well, but the latter is not very exact, at least not detailed enough for a small form, and the description might also be more complete. It is besides not very likely that the same species ranges from Ava into Perak, while there occurs another species at Moulmein. A comparison of specimens of *H. bensonianum* with the Perak form may therefore result in separating the latter as a distinct species. Unfortunately, I do not possess the Ava species.

### CYCLOPHORIDÆ.

#### CYCLOTINÆ.

#### 26. *CYCLOTUS HUNGERFORDIANUS*, n. sp.

*Testa aperte umbilicata, depresso, plicis distantibus transversis sculpta, in interstitiis plicarum striis transversis subtilibus et lineis spiraliibus*



*rugosulis minutissime granulata, viridescenti-cornea, spira breviter conoides apice mamillari, nitido. Anfr. 4 teretes, ad suturam profundam planati, ultimus ad aperturam valde descendens, breviter solutus. Apertura diagonalis, circularis, peristoma continuum, rectum. Operculum testaceum, crassum; peripheria sulco late exaratum, extus valde concavum marginibus anfractuum breviter elevatis, anfractus 8 oblique plicato-striati. Diam. maj.  $7\frac{1}{2}$ , alt. 5 mill.*

HAB.—Ad Buket Pondong, leg. cl. R. Hungerford.

This species is most probably the same which is mentioned in G. Nevill's Handl. Moll. Ind. Mus., 1878, p. 256, as *Cyclotus*, n. sp., found at the same locality by Dr. E. Townsend. It belongs to the group of *C. pusillus*, Sow., *hunanensis*, Gredl., etc., which Prof. von Martens has named *Cycloti suturales* (Landschn. Ostas., 1867, p. 124).

Mr. J. de Morgan describes (l. c., 1885, p. 69) an *Aulopoma lowi* from the Kinta valley, which I suspect to be a *Cyclotus* very similar to, if not identical with, the above species. The dimensions are about the same, 8 and 5 mill., and the short description of the shell agrees very well, especially the remark that the live shell is covered with a layer of mud. This covering seems to be characteristic of the group, as I have observed it, not only in *C. hungerfordianus*, but also in all Chinese and Philippine species. The description of the operculum does not in any way point to *Aulopoma*, hitherto not known out of Ceylon. He calls it circular, horny, composed of lamellæ placed one upon another, slightly convex on the inner side. This might fairly well apply to the operculum of a *Cyclotus*, certainly not to that of an *Aulopoma*. If my supposition as to the identity of the two species be correct, the question arises whether the rules of priority require that the species should be called *Cyclotus lowi*, de Morg. I think that the publication of a *Cyclotus* as an *Aulopoma* in such an insufficient way that its identity can only be guessed, does not entitle it to priority, but, as this can only be decided after typical specimens of both species have been compared, I have thought it better to publish the species collected by Mr. Hungerford under a new name.

## 27. OPISTHOPORUS SOLUTUS, Stoliczka.

Stoliczka, J. A. S. B., xli, pt. 2, 1872, p. 266, t. z, f. 8—10. Pfeiffer, Mon. Pnæm., suppl. iii, 1876, p. 44. G. Nevill, Handl. Moll. Ind. Mus., 1878, p. 268. H. Orsua, J. de Conch., xxvii, 1879, p. 237.

Buket Pondong (Dr. Townsend, Hungerford); Penang (Stoliczka).

## 28. OPISTHOPORUS PENANGENSIS, Stoliczka.

Stoliczka, l. c., 1872, p. 265, t. z, f. 7. Pfeiffer, Mon. Pnæm., suppl. iii, 1876, p. 48. G. Nevill, Handl., 1878, p. 268. H. Orsua, l. c., 1879, p. 238.

Buket Pondong (*Dr. Townsend, Hungerford*); Penang (*Stoliczka*).

According to Crosse, Prof. von Martens considers this form to be a simple variety of *O. corniculum*, Mouss., of Java, whilst Stoliczka compared it to *O. sumatranus*, Mart., of Sumatra. The descriptions of these species do not, however, mention the two lines of short cilia above and below the periphery (as in *O. biciliatus*, Mouss.), which seems to me to be a good specific character.

### CYCLOPHORINÆ.

#### 29. SPIRACULUM ? BEGELSPERGEI, de Morgan.

de Morgan, *Le Nat.*, vii, 1885, No. 9, p. 69 (*Cyclophorus*).

"Very depressed, very widely umbilicated, 5 whorls, very finely striate; suture linear, under which there is a deep groove ("sillon") covered by the margin which forming a canal along the suture is enlarged towards the aperture and ends in a lamina ("lame") which covers the canal entirely and forms a tube of 4—5 mill. in length. Aperture oblique, nearly circular, slightly reflected, near the suture winged ("échancrée"). Colour horny above, brown at the base, a black band round the periphery, regularly arranged brown spots on the upper side which give the shell the aspect of a rolled-up snake. Operculum circular, horny, inner side presenting a spherical depression with a prominent nucleus in the centre, outer side helicoid ("hélicoïdale") furnished with very fine membranaceous lamellæ destined to render the fitting of the operculum more hermetic." Alt. 8, diam. maj. 25, diam. apert. 8 mill.

HAB.—Environs of Lahat and Pappan, Kinta valley (*J. de Morgan*), Larut (*Ind. Mus.*).

I have tried to give a literal translation of de Morgan's description, which certainly lacks the technical precision of a diagnosis, but at least permits me to recognise his species in an immature example from Larut. It is decidedly not a *Cyclophorus*: I considered the Larut specimen to be a *Pterocyclus* which might, on account of the curious canaliculated suture, be related to *Pterocyclus alberti*, Pfr. De Morgan's mention of a tube and description of the operculum point to *Spiraculum*; I should also have thought of *Rhiostoma*, but there is no mention of the last whorl being solute. Whether the species is really new or has to be combined with a Burmese or Siamese form I cannot now decide.

#### 30. SPIRACULUM KINTANUM, de Morgan.

de Morgan, l. c., 1885, p. 69 (*Cyclophorus*).

Kinta valley.

This is most probably a *Spiraculum*: the operculum is analogous to that of the last species; there is at a short distance from the aperture a small sutural tube bent backwards. The shell is greenish-brown, much depressed, the last whorl slightly solute. Diam. maj. 19, alt. 5 mill.

### 31. *CYCLOPHORUS MALAYANUS*, Bens.

Larut (*Ind. Mus.*), Buket Pondong (*Dr. Townsend* teste G. Nevill, *Handl.*, 1878, p. 267), otherwise known from Penang, Siam, Burma.

### 32. *CYCLOPHORUS SEMISULCATUS*, Sowerby.

Buket Pondong (*Dr. Townsend* teste G. Nevill, *Handl.*, 1878, p. 269, err. typ. "*C. semistriatus*").

### 33. *CYCLOPHORUS EXPANSUS*, Pfr., ? var.

G. Nevill, *Handl.*, 1878, p. 269, "appears to be new; it is near *C. cyæus*."

Buket Pondong (*Dr. Townsend*).

### 34. *CYCLOPHORUS LOWI*, de Morgan.

de Morgan, l. c., 1885, p. 69.

Kinta valley, common; Patani. According to the author's remarks this is a fine shell of 55 mill. diameter; the description is, however, so incomplete that no attempt to compare it to a known species can be made. Not even the colour of the shell is indicated. It may be *C. aurantiacus*, Schum., widely distributed in the Malay peninsula.

### 35. *LEPTOPOMA ASPIRANS*, Benson.

Buket Pondong (*Dr. Townsend, Hungerford*), Burma, Pegu, Tenasserim.

### 36. *LAGOCHILUS TOWNSENDI*, Crosse.

Crosse, J. de Conch., xxvii, 1879, pp. 200, 389, t. viii, f. 3, = *Lagochilus*, n. sp., G. Nevill, *Handl.*, 1878, p. 282, = *Cyclophorus baylei*, de Morgan, l. c., 1885, p. 69.

Buket Pondong (*Dr. Townsend, B. Hungerford*), abundant in the basin of the Perak river, especially in the Pluss valley (*de Morgan*).

Mr. Hungerford brought some specimens from the original habitat which entirely agree with the very exact description of Mr. Crosse. I am rather inclined to consider the Perak shell merely a variety of *L. trochoides*, Stoll., from Penang to which it is closely related; being, however, unable to compare specimens of the latter, I follow Messrs. Crosse and Nevill for the present.

So far as can be judged, or rather guessed, from Mr. de Morgan's short remarks on his "*Cyclophorus baylei*," it is a *Lagochilus* and most probably identical with *L. townsendi*, Crosse.

## ALYCEMINÆ.

37. *ALYCEUS GIBBOSULUS*, Stoliczka.

Stoliczka, J. A. S. B., xli, pt 2, 1872, p 268, t. x, f. 14. Pfeiffer, Mon. Pneum., suppl. iii, 1876, p 58. G. Nevill, Handl., 1878, p 295. Crosse, J. de Conch., xvii, 1879, p. 339, t. xii, f. 8.

Originally described from Penang, but found at Bukit Pondong by Messrs. Townsend and Hungerford. The Perak form presents some slight differences, viz., pale whitish colour, broader base, and more inflated last whorl, but these do not justify the separation even as a variety.

38. *ALYCEUS PERAKENSIS*, Crosse.

Crosse, J. de Conch., xvii, 1879, pp 206, 339, t. xii, f. 7.

Discovered by Dr. Townsend at Bukit Pondong, where Mr. Hungerford also collected it in some numbers. Crosse justly compares it with *A. jagori*, Mart., from Java, from which it is, however, well distinguished by its greater size and bright yellow colour, the smaller number of its whorls, its spiral sculpture.

39. *ALYCEUS DIPLOCHILUS*, n. sp.

*Testa late umbilicata, depressa, subdiscoides, solidula, subtiliter subdistanter costulato-striata, nitidula, rubescenti-cornea; spira breviter conoidea apice obtuso. Anfr. 4 convexi, ultimus ad peripheriam obtuse angulatus, basi valde inflatus, gibbus, ab apertura sat remote (ca. 2 mill.), profunde constrictus, dein tumidulus, sub tubulo suturali brevi ca.  $\frac{1}{2}$  mill. longo dense costulatus, ad aperturam glabratus, valde deflexus. Apertura maxime obliqua, subcircularis, peristoma duplex, internum continuum, expansum, externum ab illo sulco distincto separatum, latissime expansum. Diam. maj. 4, min. 3, alt. 2 mill.*

HAB.—Ad Bukit Pondong, leg. ol. R. Hungerford.

40. *ALYCEUS OLIGOPLEURIS*, n. sp.

*Testa sat aperte umbilicata, depressa, subdiscoides, distanter et minute costulata, albescent, nitidula, spira brevissime conoidea, apice obtuso. Anfr. 3 $\frac{1}{2}$ —4 convexi, ultimus basi inflatus, gibbus, ab apertura sat remote constrictus, dein tumidulus, subglabratus, ad aperturam subito deflexus, sub tubulo suturali brevissimo densissime costulatus. Apertura maxime obliqua, subcircularis, peristoma duplex, internum porrectum, duplicatum, externum sulco distincto ab illo separatum, expansum, reflexiusculum. Diam. maj. 2 $\frac{1}{2}$ , min. 1 $\frac{1}{2}$ , alt. 1 $\frac{1}{2}$  mill.*

HAB.—Ad Bukit Pondong, leg. ol. R. Hungerford.

Related to the last, but much smaller, more distantly ribbed, ultimate whorl without angulation at the periphery, the inner peristome much more prominent and the outer less widely expanded.

#### 41. *ALYCEUS MICRODISCUS*, n. sp.

*Testa aperte umbilicata, discoidea, densissime costulata, cornea, spira brevissime prominula. Anfr. 3½—4 convexi, ultimus valde remote ab apertura leviter constrictus, dein distortus et ascendens, ad aperturam breviter deflexus, subtus paullum inflatus, gibbus, tubulus suturalis brevissimus. Apertura parum obliqua, subcircularis, peristoma duplex, externum expansum, reflexiusculum, internum porrectum, expansiusculum. Diam. maj. 2½, min. 1½, alt. 1 mill.*

HAB.—Ad Buket Pondong, leg. cl. R. Hungerford.

The peculiar distortion of the last whorl, which first ascends after the constriction and is then again deflected towards the aperture, separates this minute species from all forms known to me.

#### 42. *ALYCEUS PARVULUS*, n. sp.

*Testa sat aperte umbilicata, discoidea, confertim et minute costulata, cornea; spira brevissime prominula; anfr. 3½—4 convexi, ultimus paullum ab apertura remote leviter constrictus, dein tumidulus, basi parum inflatus, subgibbus, tubulus suturalis brevissimus; apertura diagonalis, circularis, peristoma duplex, externum late expansum, internum late porrectum, expansiusculum. Diam. maj. 1½, alt. ¾ mill.*

HAB.—Ad Buket Pondong, leg. cl. R. Hungerford.

Another minute form, still smaller than the last, to which it appears somewhat related. It differs, however, in the constriction being comparatively nearer to the aperture, the almost regular last whorl, the broad outer and very prominent inner peristome.

#### 43. *ALYCEUS MICROCONUS*, n. sp.

*Testa umbilicata, globoso-conica, costulis confertis transversis et lineis spiralibus quasi reticulata, cornea; anfr. 4 convexi, ultimus post aperturam leviter constrictus, sub tubulo suturali modico densius costulatus, dein subglabratus, non descendens. Apertura parum obliqua, fere circularis, peristoma breviter expansum, tenue, subduplicatum. Diam. maj. 1½, alt. 1½ mill.*

HAB.—Ad Buket Pondong, leg. cl. R. Hungerford.

By the conical shape, the regular last whorl, the reticulate sculpture this small species is very well distinguished from all Indian *Alyceus*.

Mr. J. de Morgan describes, in the paper already mentioned, two species of *Alyceus* from Perak, one of which appears to be a remarkable novelty.

#### 44. *ALYCEUS JOUSSEAUMEI*, de Morgan.

de Morgan, *Le Natural.*, vii, 1885, No. 9, p. 70.

"White, perforate, depressed, whorls convex, suture deep, last whorl very ventrose and strongly contracted a little above the circular aperture, sculptured by fine transverse striæ; above the contraction a sutural tube, the length of which varies with the age of the shell. Peristome double, reflected, presenting the form of a horseshoe, the concave side of which is turned to the umbilicus. Operculum horny, multispiral, circular, concave, inner side with a prominent central nucleus." Diam. maj. 11—15 mill., alt. 6, apert. diam. 4 mill.

So far as can be judged from this not very exhaustive description, the species would appear to be related to *A. umbonalis*, Bens., and *physis*, Bens. It is the largest form hitherto described.

HAB.—Limestone hills of the Kinta valley, summit of Mt. Lanó.

The other species, *A. chaperi*, de Morg. (l. c., p. 70), is probably *A. gibbosulus*, Stol., or at least closely related to that species; the meagre description does not, however, permit an identification with any degree of certainty.

### DIPLOMMATININÆ.

#### 45. *DIPLOMMATINA CANALICULATA*, n. sp.

*T. dextrorea*, conico-turrita, costulis acutis distantibus sculpta, corneo-flavescent, spira elongata, regulariter conica, apice acuto; anfr. 10 perconvexi, ultimus initio constrictus, penultimo multo angustior, ad aperturam ascendens. Apertura verticalis, angulato-subcircularis, peristoma duplex, externum late expansum, reflexiusculum, internum sulco ab illo separatum, expansiusculum, superne appressum. Columella basi truncata, cum margine basali angulum canaliformem formans. Lamella columellaris, validiuscula fere ad marginem producta. Alt. 5, diam. 2 mill.

HAB.—Ad Bukit Pondong, leg. ol. R. Hungerford.

This novelty is well characterized by the long regular conical spire, the distant and very sharp ribs, the curious angle at the base of the columella, which forms almost a canal and is distinctly continued into both peristomes. The latter are prolonged round this angle into a spur-like excrecence. Similar formations are observed in several Indian and Chinese species, but in none are they so well developed as in this.

## 46. DIPLOMMATINA NEVILLI, Crosse.

Crosse, J. de Conch., xxvii, 1879, pp. 208, 229, t. viii, f. 2 (*Palaina*).

Discovered by Dr. Townsend and also found by Mr. Hungerford at Buket Pondong. I do not know why the author classes it as a *Palaina*; it appears to me to be a typical *Diplommatina* with well-developed columellar lamella. The truncation of the columella and the canal-like angle at its base are similar to those of the last-named species, though not quite so distinct. It is only 3 mill. long.

## 47. DIPLOMMATINA CROSSEANA, Godwin-Aust. &amp; G. Nev.

Godwin-Austen & Nevill, P. Z. S., 1879, p. 738, t. lx, f. 3, 3a.

Buket Pondong (*Dr. Townsend, R. Hungerford*).

Very small, only  $1\frac{1}{2}$  mill. in length, dextrorse, antepenultimate whorl the largest. I believe it to belong to the section *Dianota*, Mart.

## 48. DIPLOMMATINA MIRABILIS, Godwin-Aust. &amp; G. Nev.

Godwin-Austen & Nevill, l. c., p. 739, t. lx, f. 4, 4a, 4b.

Buket Pondong (*Dr. Townsend*), not found by Mr. Hungerford. Dextrorse,  $1\frac{1}{2}$  mill. in length. From the figure and description I see no reason why it should be classed as *Palaina*, as the authors have it.

## 49. DIPLOMMATINA SUPERBA, Godwin-Aust. &amp; G. Nev.

Godwin-Austen & Nevill, l. c., p. 739, t. lx, f. 5, 5a (*Palaina*).

Buket Pondong (*Townsend and Hungerford*).

This truly "superb" little shell presents, it is true, some similarities with species of *Palaina*, but chiefly in the sculpture, on which subgeneric distinctions should not be based. On account of the constricted penultimate whorl I should class it as a *Dianota*.

## 50. OPISTHOSTOMA PAULUCCIE, Crosse &amp; Nevill.

Crosse & Nevill, J. de Conch., xxvii, 1879, pp. 197, 205, 239, t. viii, f. 1. Godwin-Austen & G. Nevill, Proc. Zool. Soc., 1879, p. 738, t. lx, f. 2, 2a, 2b.

## 51. OPISTHOSTOMA PERAKENSE, Godwin-Aust. &amp; G. Nev.

Godwin-Austen & Nevill, l. c., p. 738, t. lx, f. 1, 1a, 1b.

Of these two species, both discovered by Dr. Townsend at Buket Pondong, Mr. Hungerford has, so far as I can see, only found the latter at the same locality.

## PUPININÆ.

## 52. PUPINA AETATA, Bens.

Buket Pondong (Dr. Townsend, R. Hungerford). Known from Ava, Burma.

## 53. PUPINA ABULA, Bens.

Buket Pondong (Townsend and Hungerford), otherwise known from Burma.

## 54. MEGALOMASTOMA (COPTOCHILUS) SECTILABRUM, Gould.

Perak (Dr. Townsend), Larut (Ind. Mus.). Described from Tavoy, Tenasserim, and found also on Penang.

## 55. HYBOCYSTIS ELEPHAS, de Morgan.

de Morgan, Le Natural., vii, 1885, No. 9, p. 70.

*Testa anguste umbilicata, pupinæ-formis, solidissima, sublaevigata, in anfractu ultimo distinctius rugoso-striata, rufo-carnea vel aurantiaca, spira irregularis ovata, apice conoideo-obtuso; sutura impressa, marginata albescens; anfr. 6 convexiusculi, penultimus multo longior, supra aperturam planatus, dorso inflatus, ultimus angustior valde descendens, ante aperturam paullulum ascendens. Apertura verticalis, angulato-circularis, intus aurantiaca, peristoma multiplicatum crassissimum, aurantiacum, subtus protractum, margine externo ad angulum insertionis sursum producto. Operculum normale, intus castaneo-callosum, anfr. 2½—3, estus convexiusculum, albidum, anfr. 7, marginibus lamellatim elevatis. Axis 47, diam. anfr. penult. 23, aperturæ diam. intus 15½, c. perist. 19½. Peristoma usque ad 8 mill. crassum.*

HAB.—Per totam vallem fluminis Perak (J. de Morgan), Larut (Ind. Mus.).

The small collection from Larut which I received for inspection in 1885, contained this magnificent species, and I had determined to name and to describe it when I saw the notice of de Morgan's paper containing two species of *Hybo cystis*. Presuming that one of these might be the Larut form, I delayed the publication until I had received the paper itself. Although the author's description is again insufficient, still I am convinced that his *H. elephas* from Perak is the same as the one from Larut. He gives even greater dimensions: long. 50—57, diam. 24—27, diam. apert. 17—20 mill.

If I am tolerably certain of this identification, I am not quite sure that the shell is really a novelty. There are three species of *Hybo cystis* known, *H. gravis*, Bens., from Burma (Moulmein), *monhoti*, Ptr., from Cambodia,



and *myersi*, Haines, from Siam. Of none of these I have been able to compare specimens; from the published descriptions I glean the following differences between the four forms.

| Name         | <i>gracida</i>                                                  | <i>mouhoti</i>                                                        | <i>myersi</i> .                                    | <i>elephas</i> .                                                                                                        |
|--------------|-----------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Axis         | 35                                                              | 35                                                                    | 30                                                 | 50—57 mill.                                                                                                             |
| Umbilication | Perforate                                                       | Subumbilicate                                                         | Narrow                                             | Narrow.                                                                                                                 |
| Colour       | Whitish brown (fusco albida)                                    | Deep violet brown (nigrescente fusco violacea)                        | Inconspicuous brown (carneo fusca)                 | Reddish inconspicuous orange.                                                                                           |
| Sculpture    | Rather smooth (levissimula, vix striatula)                      | Slightly striate (striatula)                                          | Sublaevigata                                       | Sublaevigata.                                                                                                           |
| Last whorl   | * * *<br>Slightly and suddenly ascending                        | 1 ovolute mal leatus<br>Deeply descending ascendent at the aperture   | With irregular spiral sulci (obliquely descendent) | With distinct rather irregular transverse stripes.<br>Strongly descending, close to the aperture very little ascending. |
| Suture       | Impressed, marginate                                            | Not mentioned                                                         | Slightly impressed                                 | Impressed, very distinctly marginate.                                                                                   |
| Aperture     | Circular                                                        | Angulate oval                                                         | Angulate oval                                      | Almost circular.                                                                                                        |
| Peristome    | Whitish, incrassate, with an inner groove (intus late sulcatum) | Orange red, duplicate, outer margin at the insertion produced upwards | Incrassate, the upper insertion angulate           | Orange, multiplicate, abnormally thick, outer margin at the insertion produced upwards.                                 |

Imperfect as this comparison from mere diagnosis must necessarily be, it seems to entitle the Perak shell to specific distinction.

56. Mr. de Morgan mentions (l. c. p. 70) a second species, *H. lessaei*, de Morg., from the Pinang valley, which is said to differ from *H. elephas* by the much smaller size, the white colour, the greater size of the last whorl at its beginning, the penultimate whorl having a rather prominent gibbosity at the right side, the flattening of the last whorl being more distinct, the margination of the suture deeper, the suture more impressed, the narrower umbilicus, and the less reflected peristome.

operculum has on the inner side a small dish-like prominence with a central nucleus, the outer side is more convex than in the last species. Axis 45, diam. 21, apert. diam. 15 mill. As the author does not mention how many specimens he found of this species which accompanied *H. elephas*, it may be but an individual deviation.

#### HYDROCENIDÆ.

57. *GEORISSA MONTEROSATIANA*, Godwin-Austen & G. Nevill.

Godwin-Austen & Nevill, Proc. Zool. Soc., 1879, p. 739, t. lix, f. 6.

Buket Pandong (*Dr. Townsend, B. Hungerford*).

58. *GEORISSA SEMISULPTA*, Godwin-Austen & G. Nevill.

Godwin-Austen & Nevill, l. c., p. 740, t. lix, f. 8, 8a.

Based on a broken specimen from Buket Pandong, not found by Mr. Hungerford.

---

I have not seen any freshwater shells from Perak; the second volume of Nevill's Handlist (1884) mentions only the following species from that region :—

p. 6. *AMPULLARIA TURBINIS*, Lea, var. *SUBAMPULLACEA*, G. Nev.  
Perak (*Dr. Townsend*).

p. 22. *PALUDINA BENGALENSIS*, Lam., subspec. *POLYGRAMMA*, v. Mart.  
Qualla Kangsa (*Dr. Townsend*).

p. 256. *MELANIA EPISCOPALIS*, Lea,  
Qualla Kangsa (*Dr. Townsend*).

p. 280. *MELANIA JUGICOSTIS*, Hanley.  
Qualla Kangsa (*Dr. Townsend*).

Manila, August, 1886.

---

XVII.—*On Solar Thermometer Observations at Allahabad.*—By S. A. HILL, B. Sc., *Meteorological Reporter to the Government of N.-W. Provinces.*

[Received October 26th, —Read November 3rd, 1886.]

In April, 1883, I sent to the Society a paper on the measurement of solar radiation by means of the black-bulb thermometer *in vacuo*,\* in which paper a very decided variation of solar heat emission during

\* See Journal Vol. LII, Part II.

the sun-spot period was suggested. Last year also, I published a paper in this Journal,\* in which a very similar conclusion was arrived at, by a totally distinct method, from the observations made on certain days at Lucknow. In the first paper, the monthly mean excess of the solar thermometer on clear days above the air temperature at noon was compared with the barometric pressure and the tension of vapour, as well as with a number representing a proportionate estimate of the amount of dust and haze in the month, and then, by combining the observations of the several months by means of Pouillet's formula (which makes allowance for the varying thickness of the atmosphere traversed by rays from the sun at different altitudes), transmission co-efficients for the various constituents of the atmosphere were computed. These co-efficients then served to correct the original observations to what would have been their probable value if there had been no atmospheric absorption, and it was in the annual means of such corrected observations that the variation in the sun-spot period appeared most distinctly.

In discussing the Lucknow observations, those taken with a non-registering thermometer at different hours of the same day were compared, and the "solar constant" was computed by Pouillet's formula. The resulting mean values, though founded on at most only four days' observations in each month, gave a very similar variation to that deduced from the Allahabad results, the maximum falling in 1878, which was the minimum year of the last sun-spot cycle.

The solar thermometer brought into use at Allahabad in 1876, a large one by Negretti and Zambra, continued to be used under nearly identical conditions until this year, when it was removed to the new observatory. It had been my intention to keep the exposure of the instrument as nearly constant as possible for ten or eleven years, when if any appearance of a cyclical variation were found in the observations, it might with much probability be assigned to real changes occurring in the sun. During my absence from India in 1883-84, however, the position of the instrument was changed, and the readings of it were permanently increased (apparently by reflection from a small mango tree) to the extent of about 2 degrees as empirically determined. In Table I., which gives a summary of the observations for ten years, the vitiated observations thus empirically corrected are printed in sloping figures.

\* Vol. LIV, Part II.

TABLE I.—*Excess Temperature of the Sun Thermometer on Clear Days above the Air Temperature at Noon.*

| Year. | Jan  | Feb  | Mar  | April. | May. | June. | Oct. | Nov. | Dec. | Mean. |
|-------|------|------|------|--------|------|-------|------|------|------|-------|
| 1876  | 66 1 | 65 7 | 68 9 | 60 0   | 56 5 | 57 3  | 60 8 | 64 0 | 64 0 | 62 0  |
| 1877  | 63 0 | 66 7 | 63 6 | 62 4   | 60 0 | 57 4  | 59 8 | 63 0 | 63 4 | 62 1  |
| 1878  | 65 9 | 64 3 | 65 2 | 64 5   | 62 3 | 57 8  | 59 6 | 64 7 | 64 6 | 63 2  |
| 1879  | 64 3 | 63 9 | 63 7 | 62 6   | 61 8 | 61 0  | 61 1 | 64 9 | 63 5 | 63 1  |
| 1880  | 63 0 | 63 8 | 60 3 | 59 9   | 62 0 | 61 5  | 58 3 | 62 5 | 60 6 | 61 3  |
| 1881  | 62 3 | 60 9 | 61 9 | 60 4   | 60 3 | 63 0  | 54 8 | 61 8 | 59 9 | 60 6  |
| 1882  | 60 5 | 61 5 | 60 1 | 61 1   | 60 6 | 59 1  | 54 0 | 62 2 | 58 2 | 59 3  |
| 1883  | 60 9 | 61 5 | 61 0 | 58 4   | 57 6 | 57 1  | 59 2 | 59 8 | 58 2 | 59 3  |
| 1884  | 58 3 | 60 5 | 59 3 | 61 1   | 58 9 | 55 9  | 64 1 | 65 3 | 63 5 | 60 8  |
| 1885  | 63 2 | 66 2 | 68 0 | 62 2   | 61 0 | 58 1  | 61 6 | 64 3 | 63 6 | 62 6  |
| Mean  | 62 7 | 63 5 | 62 2 | 61 3   | 60 1 | 58 8  | 59 4 | 63 2 | 62 0 | 61 5  |

In this table, as in those already published, *clear* days are understood to be those on which the cloud proportion at 10 A. M. and 4 P. M. does not exceed one-fifth of the expanse. Such days are so uncommon in July, August, and September that these three months could not be included. The column of annual means indicates clearly a cyclical variation in the ten years, the maximum occurring in 1878-79 and the minimum falling about the end of 1883, hence, if such a variation appears in the computed values of the so-called solar "constant" given below, it cannot be set aside as a merely arithmetical result, since it is founded upon a similar variation in the data obtained by direct observation. The monthly means at the foot show a maximum in February and another in November, with a faintly marked minimum in the cold weather and another more distinctly marked in June. They should, however, be multiplied by the square of the earth's mean radius vector for each month to correct for the varying distance of the sun, before they can be properly compared, a point which was overlooked in my paper of 1883. When thus corrected they stand as follows:—

|       |       |        |        |       |       |       |       |       |
|-------|-------|--------|--------|-------|-------|-------|-------|-------|
| Jan.  | Feb.  | March. | April. | May.  | June. | Oct.  | Nov.  | Dec.  |
| 60.7° | 62.0° | 61.7°  | 61.8°  | 61.5° | 60.7° | 58.9° | 61.8° | 60.0° |

If the absorptive power of the atmosphere were constant, we should expect to find the maximum result in June, when the sun rises highest in the heavens, and the minimum in December, when the incidence is most oblique and the thickness of the atmosphere to be traversed by the rays is greatest. The actual variation which gives maxima in February or April and in November and minima in December and October must be due to the modifying influence of a variability of absorption.

For this only two causes in the least degree likely to produce the observed effect suggest themselves, changes in the quantity of water vapour in the air and changes in the thickness of the dust haze of the dry months.

Regarding the proportionate quantity of the latter in the several months, I think the scale laid down in my paper on the Lucknow observations probably represents the truth more exactly than that assumed in my former paper on the Allahabad results. This scale is:—

| Jan. | Feb. | March. | April | May. | June | Oct. | Nov. | Dec. |
|------|------|--------|-------|------|------|------|------|------|
| 3    | 5    | 7      | 9     | 10   | 6    | 0    | 1    | 2    |

The pressure of vapour and the total pressure of the air (which does not differ by more than one per cent from the true pressure of the dry air alone) are given in the next two tables. The figures for June\* are for the first half of the month only, the clear days as a rule being confined to this half

TABLE II.—*Mean Pressures of Water Vapour.*

| Year | Jan  | Feb  | Mar  | Apr  | May  | June | Oct  | Nov. | Dec. | Mean. |
|------|------|------|------|------|------|------|------|------|------|-------|
| 1876 | 312" | 295" | 350" | 330" | 524" | 700' | 678" | 447" | 348" | 442"  |
| 1877 | 428  | 319  | 450  | 534  | 592  | 775  | 642  | 474  | 424  | 519   |
| 1878 | 364  | 131  | 392  | 486  | 630  | 515  | 618  | 454  | 318  | 471   |
| 1879 | 325  | 351  | 356  | 325  | 461  | 568  | 704  | 305  | 306  | 422   |
| 1880 | 335  | 349  | 417  | 100  | 650  | 789  | 605  | 409  | 340  | 477   |
| 1881 | 281  | 357  | 131  | 438  | 642  | 859  | 612  | 352  | 200  | 475   |
| 1882 | 335  | 289  | 300  | 348  | 469  | 783  | 635  | 428  | 348  | 437   |
| 1883 | 381  | 298  | 343  | 393  | 496  | 693  | 568  | 354  | 287  | 424   |
| 1884 | 335  | 312  | 315  | 293  | 433  | 608  | 663  | 423  | 373  | 417   |
| 1885 | 396  | 291  | 352  | 374  | 474  | 563  | 616  | 401  | 386  | 426   |
| Mean | 350  | 332  | 371  | 392  | 540  | 685  | 637  | 411  | 343  | 451   |

TABLE III.—*Mean Barometric Pressure. 29 inches + .*

| Year. | Jan. | Feb | Mar. | Apr | May | June | Oct. | Nov. | Dec. | Mean. |
|-------|------|-----|------|-----|-----|------|------|------|------|-------|
| 1876  | 681  | 626 | 541  | 389 | 300 | 199  | 605  | 670  | 787  | 533   |
| 1877  | 795  | 736 | 585  | 506 | 369 | 308  | 601  | 678  | 733  | 560   |
| 1878  | 771  | 704 | 599  | 478 | 390 | 205  | 482  | 615  | 683  | 570   |
| 1879  | 723  | 646 | 554  | 402 | 274 | 219  | 546  | 686  | 717  | 530   |
| 1880  | 679  | 662 | 509  | 390 | 305 | 184  | 562  | 737  | 768  | 536   |
| 1881  | 779  | 600 | 598  | 417 | 323 | 194  | 519  | 653  | 743  | 547   |
| 1882  | 751  | 652 | 557  | 416 | 337 | 129  | 493  | 689  | 711  | 534   |
| 1883  | 731  | 683 | 553  | 400 | 268 | 185  | 599  | 655  | 797  | 532   |
| 1884  | 770  | 669 | 537  | 435 | 297 | 241  | 608  | 706  | 794  | 536   |
| 1885  | 781  | 666 | 564  | 453 | 416 | 264  | 559  | 714  | 715  | 539   |
| Mean  | 736  | 672 | 562  | 430 | 327 | 207  | 557  | 679  | 749  | 537   |

From the monthly means of the excess temperatures and of these elements, as well as the proportionate figures for dust haze, we may compute the transmission co-efficients of the several constituents of the atmosphere by a modification of Pouillet's formula. For, putting  $R$  to stand for the observed radiation (as given in Table I.) and  $S$  for the solar "constant," we have  $R = S \cdot a^{be} \beta^f \gamma^{de}$ , where  $a$  and  $\beta$  are the transmission co-efficients of air and vapour, each of one inch pressure,  $\gamma$  the transmission co-efficient for dust haze of one-tenth of the density observed in May,  $e$  the atmospheric thickness traversed by the rays at noonday compared with the vertical depth of the atmosphere, and  $b, f$ , and  $d$  the pressures of air and vapour and the proportion of dust respectively. Remembering that, for the obliquities we have to deal with,  $e$  is as nearly as possible equal to the secant of the zenith distance, we may for purposes of calculation put the equations into the form:—  
 $\log R = \log S + b \sec. s \log a + f \sec. s \log \beta + d \sec. s \log \gamma$ , and the equations for the nine months are more than sufficient to determine all the unknown quantities.

The observations of Mr. Hennessey at Mussoorie and Dehra in 1869 and 1879, however, probably give more accurate values for the transmission co-efficients of air and water vapour than could be determined in this way, and I therefore adopt them now. These values (*see* P. R. S., No. 219, 1882, page 435) are:—

$$a = \cdot 998555$$

$$\beta = \cdot 72783$$

Inserting these in the equations for the nine months, we find  $\gamma = \cdot 99449$  and  $S = 82^\circ 29$ .

The value of  $\gamma$  shows that in May, when the dust haze is a maximum and the sun's rays nearly vertical, the absorption by dust does not much exceed 5 per cent. This result is probably only brought about by the circumstance that the reflection from dust particles in all directions round the thermometer bulb is nearly equal to the absorption by those particles which lie in the direct path of the solar beam, but it suffices to show that any error of moderate extent in estimating the proportionate quantity of dust for a given month or year will have little effect on the computed value of the solar constant. The quantity of water vapour in the air can be determined with a considerable degree of exactness, and, when its pressure at the place of observation is about an inch, it absorbs 27 per cent. of the incident radiation. The figures in Table I. can therefore now be corrected for atmospheric absorption as were those in my first paper. The resulting values of the solar "constant," corrected also to the earth's mean distance from the sun, are the following:—

| Year. | Solar Constant. |
|-------|-----------------|
| 1876  | 82 8°           |
| 1877  | 85 1            |
| 1878  | 85 2            |
| 1879  | 83 6            |
| 1880  | 82 7            |
| 1881  | 81 8            |
| 1882  | 79 6            |
| 1883  | 78 6            |
| 1884  | 80 4            |
| 1885  | 83 1            |

If these results are to be trusted, they show that, during the cycle of visible change on the sun's surface, there is a cyclical variation of large range in the heat emitted by him, the maximum of emission coinciding with, or perhaps slightly preceding, the phase in which his surface is most uniformly bright, and the minimum coinciding with the phase of greatest disturbance, which is also apparently that of greatest absorption of the photospheric radiation by the sun's atmosphere. For, in 1878, the surface of the sun was less disturbed by spots than in any other year of the ten, while the spots were most frequent and occupied the greatest area in 1883. This conclusion, which, so far as the minimum phase of the sun-spots is concerned, was deducible from the observations published in my paper of 1883, is confirmed by the average variation of the intensity of solar radiation all over India, as deduced in the annual meteorological reports, though probably, on account of the somewhat rough and ready way in which the observations are combined in those reports, the variation is not so uniform as it would be if a more elaborate method of reduction were adopted; it is also confirmed by the variation of temperature all over India and probably in other tropical countries, Koppen having long since shown that the temperature of the torrid zone varies inversely with the frequency of sun-spots; I have also found it distinctly confirmed by a series of ground-temperature observations made at Allahabad, and, so far as evidence collected only on this side of the world goes, it may be considered as fairly established. It is desirable, however, that contemporaneous observations made in America, or in some other distant region, should be investigated with a view to testing the truth of this variation in the sun's heating power; for, though a variation in the direction here indicated seems to me not opposed to anything we know of the constitution of the sun, but rather to be expected from the changes observed on his surface, the antecedent probability is very small that the variation

would be of anything like so great a range as that just found, a range from maximum to minimum of about 11 per cent. of the mean heating effect.

XVIII.—On probable Changes in the Geography of the Punjab and its Rivers: an Historico-Geographical Study.—By R. D. OLDHAM, A. R. S. M., Deputy Superintendent, Geological Survey of India.

[Received 30th September;—Read December 12th, 1886.]

(With a Map—Pl. XIX.)

*Introductory.*—Of all the problems with which we are brought in contact when we try to unravel the ancient geography of India, none surpass in interest or difficulty those connected with the rivers of the Punjab and Sind. Both interest and difficulty result from the fact that, previous to the advent of the English, all civilization and every invader have entered India from the North-West, and their difficulty from the changes that appear to have taken place in the courses of these rivers during the last three thousand years. It cannot be said that this subject has been neglected by previous writers on the ancient geography of India, but their efforts have mainly been addressed to the identification of towns or countries, and their references to the rivers are often marked by an ignorance, or neglect, of the fundamental principles of physical geology; yet the matter is one on which the geologist must be heard as well as the scholar, for, whatever dependence may be placed on history or tradition, the conclusions that are drawn are only valid so long as they are possible, and no one that has not studied the mode of action of rivers on a geological basis can decide whether any particular change in the course of a river, of which there appears to be historical indication, can or cannot have taken place.\*

\* Throughout the following paper, I am largely indebted to the author of an anonymous essay in the Calcutta Review, on the "Lost River of the Indian Desert", (vol. lix, pp. 1—29, understood to be by Surgeon-Major C. F. Oldham). I am indebted to this writer for having first drawn my attention to the subject, for having suggested most of the opinions supported in the following paper, and for many of the references given below. I have, however, except where the contrary is expressly stated, verified them in every case; and, to save wearisome repetition, I must request all who wish to see how little I diverge from the opinions expressed by the writer referred to, and to what extent this paper goes beyond the matter he has treated of, to compare the two, promising that the perusal of the article in the Calcutta Review will prove anything but a waste of time.



I. *On the Ancient Course of the Indus through Sind.*—It is generally supposed, and the supposition is supported by authority, that the Eastern Narra marks an old course of the Indus, and that it was down this now deserted channel that the fleet of Alexander sailed. This supposition has been adopted by General Cunningham in his 'Ancient Geography of India,' where the capital of the king Musikanus according to Strabo, Diodorus, and Arrian, or of the Musikanu according to Curtius, is identified with the town known in more modern times as Aror or Alor. He says that the ruins of Aror are situated "to the south of a gap in the low range of limestone hills, which stretches from Bhakar towards the south for about twenty miles, until it is lost in the broad belt of sand hills which bound the Nára, or old bed of the Indus, on the west. To the north-east it was covered by a second branch of the river<sup>a</sup> which flowed nearly at right angles to the other at a distance of three miles. At the accession of Rajah Dahir in A. D. 680 the latter was probably the main stream of the Indus which had been gradually working to the westwards from its original bed in the old Nára."

Leaving his fleet at Alor, Alexander\* marched against Oxycanus or Portikanus, or, according to General Cunningham's identification, Larkána, and Sindomána or Schwan, and from Sindomána he "marched back to the river where he had ordered his fleet to wait for him. Thence descending the stream he came on the fourth day to" a town which the General identifies with Brahmanabad, notwithstanding that by his own confession this lies twenty miles west of the Eastern Nára down which he has just declared that Alexander sailed. General Cunningham's identification of this town, the Harmatelia of Diodorus, with Brahmanabad seems to be satisfactory, but the more thoroughly this is the case the less likely does it seem that the Eastern Narra can mark the course of the Indus when Alexander sailed down it.

But there are more important objections than this. After leaving Harmatelia, Alexander sailed down the river to Pattala, which General Cunningham identifies with the modern Haidarabad, and from thence he sailed to the sea by two different courses, one of which took him to near Karachi, the other to the Ran of Kachh. It seems clear that Alexander's historians placed the head of the Delta at or near Patala, which cannot have been much further from the sea than Haidarabad, for Onesikritus says that all three sides of the Delta were equal†; in any case it was below Harmateleia. But as Harmateleia and Brahmanabad are the same, and, as this place lay twenty miles west of the Eastern Narra, the Indus must in some manner have broken westwards from the bed of the Narra

\* Cunningham, *Ancient Geography of India*, p. 267 et seq.

† Cunningham, *op. cit.*, p. 263.

and wandered over higher ground. In the text there is nothing to shew that General Cunningham appreciated this difficulty, but in the map a compromise seems to be attempted which, the usual fate of such attempts, can hardly be called satisfactory. I say seems, for in this map—as in all the maps illustrating the work, but more conspicuously in this—an attempt has been made to represent, without any distinguishing mark, both the present and the ancient courses of the rivers. On the map in question (No. IX), the “*Narra R. (ancient course of the Indus)*” leaves the existing course of the Indus about thirty miles north of Aror and flows nearly due south to Jakrao, whence a course is marked running S. W. by Brahmanabad to Patala. From Jakrao, another course diverges to the S. E., and, after reaching the latitude of Amarkot, turns S. S. W. and flows into the Ran—or perhaps into a lake, for it is by no means clear whether General Cunningham supposed the Ran to have existed in Alexander’s times—shortly after joining a branch of the Indus which flows S. S. E. from Patala, but whether this eastern line is supposed to mark an ancient course of the Indus or to represent the dry bed of the Narra is not clearly shewn, but either supposition would be equally impossible. The accounts of the Arab historians and geographers shew that from the 8th century the Indus flowed past Mansura, until, in the 13th century, it abandoned this course for one further to the west, which it has since maintained, and the supposition that the Eastern Narra marks the ancient course of the Indus lands us on one of the horns of a dilemma, for, if the Indus flowed down the Narra as far as Jakrao, and the present continuation was then in existence, it is inconceivable that the river should have left this lowland to wander up hill, through the higher land to the west; nor, if this line is meant to represent the present channel of the Eastern Narra, which did not exist in Alexander’s time, is it possible satisfactorily to explain the excavation of this channel. I have not written the above in any spirit of captious criticism, but merely to shew the difficulty that attaches to the elucidation of the ancient geography of Sind if we accept the prevalent idea, inconsistent as it is with the known principles of physical geography, that the Eastern Narra represents an ancient course of the Indus.

• § 2. The Indus in its course through Sind flows between banks that are raised above the general level of the country, which slopes away on either side. This is a feature common to all rivers which are raising the level of their alluvial plains by the deposit of silt, but, at Bukkar, the Indus exhibits a feature which is exceedingly rare, if not without a parallel, in the case of any other river, for here it flows at the higher level through a gap in a low range of hills surrounded on either side by

alluvium at a lower level than that of the river where it passes through the gap. It is difficult to give any satisfactory explanation of this feature if we suppose the Indus to be the only river that ever flowed in this region, but I hope to shew that there are both historical and geographical indications of the former existence of a river which flowed to the Ran of Kach, independent of the Indus, and, if we admit its existence, the following hypothesis may be offered as a possible explanation of the existing peculiarity in the course of the Indus.

In former times, the Indus wandered over the plain which surrounds the Khairpur hills, raising the level of the soil on either bank till it broke away into the low ground on one side or the other, and so by degrees raising the level of every part; during the latest phase of this process, previous to the origin of the existing conditions, it flowed east of its present course and, having raised the level of the ground there, wandered away westwards; by this time the surface of the alluvium had been raised till it was level with a gap in the Khairpur hills at Rohri, and, as the alluvium south of the ridge would probably be at a considerably lower level than on the north side, the waters of the Indus, having once found an outlet through this gap, would soon establish a permanent course for themselves. If then we assume that the other river instead of depositing silt and raising the level of its alluvium was an eroding stream, we may suppose that it gradually worked westwards till it reached the present situation of the Eastern Narra and excavated that channel: the flood waters from the Indus would smooth off the slope between them, and, had the process continued, there can be little doubt that the Indus would soon have broken away into this low lying channel, had not the other river, owing to a change of course in its upper reaches, dried up before this happened. It may seem strange that two rivers should have flowed so close to each other under such different conditions, but it must be remembered that, if the second river was small in comparison with the Indus, it may well have deposited all its silt higher up its course, and consequently have had none to deposit when it reached the latitude of Rohri.

So far I have merely proposed a possible hypothesis to account for the known peculiarity of the course of the Indus, but I hope to be able to shew that there is both historical and geographical evidence of the former existence of this second river.

§ 3. The commonly accepted opinion that the Eastern Narra marks the former course of the Indus is no doubt due to a prevalent tradition, so that effect among the natives of the country; but it must be borne in mind that these traditions often arise from an endeavour to explain

known phenomena, and that when they have their origin in historical fact, this has become so modified by the alteration inherent in oral transmission, not to mention that resulting from a change from prose to verse, that it is impossible to separate the original foundation of fact from the superstructure of fable. Nevertheless, as no tradition ever arose without some foundation in fact, whether an historical occurrence or a phenomenon requiring explanation, these legends must not be neglected, but rather regarded as valuable hints as to the direction that research should take, although they can never be appealed to as proof. But even legend throws some doubt on the correctness of the common idea, if we may believe the following quotation from the *Tarikh-i-Tahiri*. After mentioning the size of the ruins of Muhammad Tur, the capital of the Sumra chiefs of Sind, he gives the following account of its destruction: "The cause of the ruin of the above-named city and its dependencies which had flourished between 900 and 1000 years was as follows. Below the town of Alor (Aror) flowed the river of the Panjab which was known as the Hákra, Wahind, Dahan, and by others, for it changes its name at every village by which it flows, after fertilising the land the river poured its waters into the sea." The legend then goes on to say how, as a result of the oppression and lust of Delu Rai, who ruled all the land between the capital and Aror, the Hákra was diverted into the present bed of the Indus.\* This exhibits the legend in a form slightly different from that which it now takes; and the mention of Muhammad Tur as well as the names of the river, Hákra, Wahind, and Dahan, none of which are applied to the Indus, but all of which are applied to a dry river bed further east in which the Indus has certainly not flowed within the historic period, all points to the conclusion that the legend originally referred to the drying up of that second river whose existence I have hypothetically inferred. The change that has come over it is easily understood, for to this day part of the flood waters of the Indus find their way into the deserted bed of this river; and, when the memory of the co-existence of the two had passed away, what more natural than to suppose that what had occurred was an alteration in the course of the Indus, which, as usual, came to be attributed to the vices of the ruler of the country so laid waste.

This supposition also fits in with a tradition which, according to the writer just quoted,† is prevalent, on the borders of Bikaner, to the effect that the waters of the Hákra spread out into a great lake at a place called Kak, south of the Mer country. No place of the name of Kak is now known, but we have Kachh, which may be it, and the early Arab Historians mention a piratical tribe, the Korks or Kurks, who

\* Calcutta Review, LIX, 20.

† Calcutta Review, LIX, 17.

appear to have inhabited the shores of the Indus Delta and Kachh ; but, however this may be, the Mers are well-known as a tribe formerly inhabiting the south-west corner of the Indian Desert to the north of the Ran of Kachh, which doubtless is the great lake referred to in the tradition.

Neither the historians of Alexander the Great's invasion of India nor the classical geographers throw any real light on this question. Ptolemy is doubtless the fullest and most complete in his list of localities, but the modern representatives of most of his towns are as yet a matter of dispute. If General Cunningham is right in identifying the Mousikanos of Arrian with Aror, it would support the generally-accepted theory, for Ptolemy places Sousikanos, which is evidently the same place, west of the Indus ; it seems to me, however, more probable that the Kamigara of Ptolemy, which he places east of the Indus, occupied the position known in later days as Aror. The ruins of this city are still known in the neighbourhood as Kaman, and this with the affix *nagar* might easily be corrupted into Kamigara.\*

From the date of Ptolemy's geography we lose all sight and knowledge of Sind until the advent of the Arab geographers and historians in the eighth century, from whom some information can be gained as to the course of the rivers in their times.

Unfortunately, the works to which one would naturally first turn are useless, or, worse still, misleading. The Arab geographers had all a very vague and general idea of Indian geography, indeed their works compare ill with our modern knowledge of Central Africa or of that *terra incognita* Central Thibet, their distances are vague and often inconsistent, their bearings are seldom correct, and, to make confusion worse confounded, they were constantly confusing places which had similar names though distinct and distant from each other—a mistake rendered easy by the character in which their books were written, and which betrays itself constantly in the fact that hardly ever do two different authors spell the same name similarly.

Of all the geographers quoted in Sir H. Elliot's History of India but two mention on which side of the Indus the town of Aror was situated : Al Masudi says that it was on the west bank of the Indus,† and Al Idrisi says that the Mihran runs to the west of Dur (Aror).‡ The contradiction here is apparent, not real, for strangely enough all the bearings given by Al Idrisi have been reversed,§ yet I cannot help thinking

\* *Ancient India as described by Ptolemy, &c.*, by J. W. McOriade, M. A., M. B. A. S., London, Calcutta and Bombay 1885, p. 151.

† Elliot's *History of India*, edited by Prof. Dowson, I, 23.

‡ Elliot, *op. cit.*, I, 79.

§ Thus he places the Persian Gulf east of the Delta of the Indus and Nowestan or Seistan, north of Turan.

that in this case his statement is really correct, though constructively wrong. In the extract from Al Istakhri it is merely stated that Alrur is situated 'near the Mihran,' but, in the map reproduced by Prof. Downson\* and extracted from the Askálu-l Bilad (a copy of Ibn Haukul's work), Alrur is clearly placed on the east bank of the Indus, on the same side as Multan and the opposite side to Sadusan and Makran. This map is said to be very similar to that of Al Istakhri, as published by Moeller, and may be regarded as probably more trustworthy than the text, into which clerical errors are so easily introduced.

But if the geographers can give us no definite information on this subject, we can at least obtain a fairly certain answer from the historians, for, in the Chachnama,† it is stated that Chach set out from Alor and after many marches reached the fort of Pabiya "on the Biyah," after capturing this fort he crossed the Biyah, and, having passed the Ravi, reached Multan: the same itinerary is given for Muḥammad Kasim's later march over the same country both in the Chachnama and by Al Biláduri,‡ and it is certain that the passage of the Indus, had it been crossed, would not have been omitted by a chronicler who was careful to mention the much smaller rivers of the Bias and Ravi. In the case of Muḥammad Kasim, the passage of the Indus at Nirun is recorded, but there is no record of his recrossing it before reaching Aror.

This should be sufficient proof that the Eastern Narra has not been the bed of the Indus, at any rate since the eighth century, but this opinion is so widely held and has been so supported by authority that it will not be amiss to bring forward still further evidence pointing in the same direction.

The Arab geographer Al Idrisi places the head of the Delta, or the place where the first distributory is given off, at Kállári, 'a hard day's journey' of forty miles from Mansura. The exact words of the translation are "at Kállári it divides—the principal branch runs towards Mansura, the other flows northwards (southwards) as far as Sharúsau it then turns westwards (eastwards) and rejoins the chief stream forming henceforward only one river. The Mihran passes on to Nirun and then flows into the sea."§ Further on it says, "Kállári on the west (east) bank of the Mihran is a pretty town well fortified and is a busy trading place. Near it the Mihran separates into two branches; the largest runs towards the west (east) as far as the vicinity of Mansuria which is on the west (east?) bank; the other runs towards the north-west

\* Elliot's *History of India*, I, 22.

† *Op. cit.*, I, 140.

‡ *Op. cit.*, I, pp. 122 and 202-3.

§ Elliot, *op. cit.*, I, 78.

(south-east) then to the north (south) and then towards the west (east). Both unite at the distance of about twelve miles below Mansura.\* It will be noticed that the bearings in these two accounts do not agree, probably in the second case we should be satisfied with turning them three quarters of a semicircle, but even then they would not cut in, and in consequence the first set, which are more consistent, must be regarded as more nearly correct; any way it is clear that the river bifurcated at a place called Kállári, forty miles or a 'hard day's journey' from Mansura, that one branch flowed by Mansura, and that the two reunited below Mansura.

At the conclusion of the second account he says that from Kállári to Sharúsan is three days. I refer to this now as the statement is puzzling, but is due to the confusion of two places of very similar names, Kállári and Bállári. On Ibn Haukal's map the town at the bifurcation of the river is called Ballari while Kalari is further north and at some distance from the river. In the text he says that Ibn and Lábrí—which Prof. Dowson identifies with Amári and Kállári—are situated east of the Indus, but distant from it. Al Idrisi's two accounts are evidently from different sources, and it is probable that either he or his informant must have confused the Bállári, or Kállári, at the bifurcation of the Indus with the other town of similar name situated to the east, which might well be three days distant from Sehwan.

The first account too is somewhat difficult of understanding, for it is impossible to understand how, from any point one day's journey—even if it be one of four miles—from Mansura, a branch of the Indus could flow south to Sehwan. It is of course a physical impossibility that the Indus should have flowed any distance northwards, and the general reversal of Al Idrisi's bearings has already been referred to. No other authority makes this statement, and the map of Ibn Haukal places Sadúsan on the west bank of the Indus above Bállári, where the river bifurcates; this is altogether a more probable disposition.

We have thus two authorities confirming each other that in the tenth or eleventh century the Indus or a branch of it flowed passed Sadúsan, which we may certainly identify with Sehwan. The Chachnámá seems to shew that the same was the case in A. D. 713, for it says that, when Muhammad Kasim besieged Siwistan (Sehwan), the river "Sindhú Ráwal" flowed north of his camp.† There can be little doubt that this was either a bend or a branch of the Indus.

It is thus clearly proved that at any rate since the commencement of the eighth century of our era the Indus has flowed west of Awar and the range of hills running southwards, and that, though it is practically

\* Op. cit., I, 79.

† Elliot, op. cit., I, 159.

certain that the Indus, or one branch of it, must have at one time flowed through the gap near Aror, it is equally certain that nothing but the flood waters then or since have flowed eastwards past Aror to the Narra, and that for the last 1100 years at least the Indus flowed west of the low range of hills running southwards from Sukkur and Aror. The tract of country between these hills and the range to the west is on the map a simple network of deserted river channels, and it will be hopeless to attempt to determine with accuracy which of these was the river course at any one particular period.

§ 4. Yet, though the Eastern Narra is not a deserted bed of the Indus, it seems probable that as late as the eleventh century it was occupied by a flowing river. My witnesses to prove this are, *1st*, the Chachnama, and, *2nd*, the Beglarnama, both translated in the first volume of Prof. Dowson's edition of Sir H. Elliot's *History of India*.

When Muhammad Kasim invaded Sindh, he sent his mangonels up the river to Niran, and, after receiving the submission of that place, he determined to go against Sehwan, and after its capture to "recross the river" and proceed against Dahir; from this it is evident that he must have crossed one of the main branches of the Indus, thus confirming other accounts which place Niran between the two main branches of the Indus. After the capture of Sehwan, he returned to Niran, where he crossed the Mibran by a bridge of boats, and went against Dahir; after crossing the river and defeating Dahir's troops, whom they pursued 'as far as the gates of Jham,' the Arab army marched on till it reached 'the fort of Bait,' where an entrenched camp was formed. Muhammad Kasim then advanced towards Ráwar and came to a "lake," but, as this had to be crossed by a boat, it was probably a branch of the river; after crossing he advanced a day's march and came to "Jewar on the banks of the Wadhawah (or according to another MS. Dadhawah).† After his defeat by Muhammad Kasim, Dahir took refuge in the fort of Ráwar, which was but a day's march from 'Jewar on the Wadhawah,' and which seems itself to have been on the Wadhawah, for, among the administrative arrangements made by Muhammad Kasim before he marched northwards, it is stated that he placed "Nuba, son of Dáras, in the fort of Ráwar and directed him to hold the place fast and keep the boats ready. If any boat coming up or down stream was loaded with men or arms of war, he was to take and bring them to the fort of Ráwar."‡ From this it is evident that Ráwar was on a navigable stream, and it remains to identify this if possible.

Elphinstone has placed Ráwar on the Indus, but this was clearly

\* Elliot, *op. cit.*, I, 158.

† *Op. cit.*, I, 158.

‡ *Op. cit.*, I, 159.



not the case, for it was several marches east of the Indus, three halting places being mentioned in the Chachnama, and the context clearly shewing that these were separated by more than a single stage; besides which the text says that, when it was known that Dahir had been killed "between the Mihran and the Wadhawah," the chiefs and officers of the Rani "took refuge in the fort," thus clearly shewing that, in the opinion of the writer of the chronicle, the Mihran and the Wadhawah were not one and the same river. This would perhaps be of little value if unsupported, but, on examining the latest maps of Sind, I find that the Narra can be traced northwards to Sahara in Lat.  $27^{\circ} 15'$ , where it ends abruptly, that thence for twenty-three miles its course is obscured and obliterated by the deposit from the flood waters of the Indus: but, in Lat.  $27^{\circ} 25'$ , Long.  $69^{\circ} 18'$ , I find a deserted river channel, called on the map the "dry bed of the river Wundun," which is continuous with the dry bed of the Hákra, traceable through Bhawalpur and Bikanir. This similarity of name certainly lends great support to the theory, originally started by the anonymous writer in the '*Calcutta Review*,'\* that the Nárra is the old bed of the Hákra which till the thirteenth century pursued an independent course to the sea.

Further evidence of the existence of another river besides the Indus in this region may be found in the Chachnama, where it is related that, on the way from Ráwar to Brahmanabad, Muḥammad Kasim laid siege to the fort of Dhalila, and "when the besieged were much distressed \* \* \* they sent out their families into the fort which faces the bridge, and they crossed the stream of the Naljak without the Musalmáns becoming aware of it." At daybreak they were pursued and overtaken as they were crossing over "the river" and "those who had crossed previously fled to Hindustan through the country of Rámal and the sandy desert to the country of Sir, the chief of which country was named Deoraj." But far more important and convincing evidence is to be found in the Beglarnáma. It is there related that, after an embassy to Jessalmer, Khán-i-Zamán (the hero of the chronicle) went towards Nasrpur, and, in the course of his journey, it is incidentally mentioned that he crossed 'the tank Sankra.'† At Nasrpur, being pressed for money, he determined on a marauding expedition against the "Sodhas at the village of Tarangohi." He set out and "crossed the waters of the Sankra," and "when Dúda and Gháni learnt that he had gone in that direction they rode after him;" but ~~these~~ youths had forgotten to ask the permission of their parents, who rode after them hot haste and reached the Sankra just as their sons were

\* Notes on the Lost River of the Indian Desert, *Calcutta Review*, LIX, 1—37.

† Elliot, *op. cit.*, I, 284.

crossing it; the latter, when they saw that their fathers had come after them, immediately "threw themselves into the stream, swam their horses over, and joined Khán-i-Zamán."<sup>\*</sup>

The Sánkra here is evidently what we now call the Narra, and the name given is the same as Hákra or Sákra, which is applied to the dry bed of the lost river in Rajputana, while the mention of the horses swimming the river shows that this must have been of some depth, quite sufficient to be navigable for country boats.

It seems then that, as late as the beginning of the eleventh century, the Eastern Narra was occupied by a considerable stream of water, and was known as the Hákra, Sákra, Wandan, Dahan, Wadhawah, Dadhawah, or Wahiud. These names really resolve themselves into three. Hákra or Sákra is the name still applied to the dry river bed which can be traced through the Western desert, where the letter S is almost invariably changed to H. The next four are also one word, D and W being easily confounded in the character in which these chronicles were written, and the termination 'wah' simply meaning a stream. While the last appears to be a separate name which translated means the "river of Hind," a name which appears of itself to separate this river from the Mihran, the "river of Sind" now known as the Indus. But I have already shewn that the Indus must have flowed west of Aror since the beginning of the eighth century, so that there is little difficulty in accepting the conclusion that the Eastern Narra marks the course of a dried up river which can be none other than that which the names applied to it indicate, the "Lost River of the Indian Desert."

II. *The Lost River of the Indian Desert.*—We lost sight of the dry bed of the old river Wandan in Lat. 28° 16', Long. 70° 33'. Above this comes a stretch of sixty miles in which the river bed has either been completely obliterated by drifting sand or at any rate is not marked on the Revenue Survey maps of Bhawalpur, but in Lat. 28° 46', Long. 71° 25' we again find a dry river bed which, under the varying names of Hakra, Sotra, Choya, &c. can be traced through Bhawalpur, Bikanir, and the Sirsa district till it is lost near Tohána in the Hissar district.

Although the connection of these two dry river beds has not yet been traced (unless we may take a passage† in the essay which has more than once been alluded to to mean that the writer had personally traced the connection), there can be but little doubt that the two were originally continuous and are the sole remaining traces of that great river which, according to the traditions prevalent throughout the desert, once flowed through this now barren tract to the sea, or, according to other accounts, to the Indus at Sukkur.

<sup>\*</sup> *Ibid*, p. 235. .

† *Calcutta Review*, LIX, 17, (1874).

As regards the date of the final drying up of this river the only evidence we have is the couplet, quoted by Col. Todd,\* which says that the river dried up in the time of the Sodah prince Hamir. A prince of that name was contemporary with the Bhatti rajah Doosaj who ascended the throne of Jessalmer in A D 1044. there is no proof that this was the same Hamir as is referred to in the couplet, but we have already found that the latest mention of the Hákra or Sáukra† as a flowing river is about 1000 A D, and that it is not mentioned in any contemporary record of later date, it is, consequently, possible that the two Hamirs are one and the same, and that the drying up of this lost river took place some time during the eleventh century.

§ 2. We have next to decide from whence came the water that filled this river bed, the first hypothesis that may be mentioned is that of M de Saint Martin. He considered that it was the Saraswati of the Vedas whose course had been shortened to its present limits through a diminution of rainfall. This hypothesis is, however, untenable, for there is no historic evidence of such an enormous climatic change as this implies, nor could such an enormous rainfall on the Himalayas have existed during the human period without leaving its traces in the boulder deposits of the streams where these issue from the hills on to the plains.

Another theory, propounded by an anonymous writer in the Calcutta Review,‡ is that the Hakra was originally occupied by the Jumna or a branch of it. Whether it may ever have carried any of the waters of the Jumna, I will afterwards consider, but it is certain that it could not have done so since the time of Manu, who mentions the Jumna as joining the Ganges at the modern city of Allahabad, and I have shewn that the Hakra was probably a flowing river at a later period than that.

The third, and to me most probable, theory is that of the anonymous essayist§ whom I have already quoted several times and shall quote still oftener, and who supposes the Hakra to be the old bed of the Sutlej, which, previous to the thirteenth century, did not join the Beas, as it now does, but pursued an independent course to the sea.

This hypothesis was warmly combated by another anonymous writer in the same periodical, and it will be convenient before passing on to the evidence in its favour to consider one argument which has been

\* *Annals of Rajasthan*; a sketch of the Indian Desert, chapter I.

† These are the same word, many of these Western Rajputs being unable to pronounce the letter S.

‡ *Calcutta Review*, LX, 351, (1875).

§ *Ibid*, LIX, pp. 1—27, (1874).

urged against it by the writer just referred to, and again by Mr. Wilson in his final report on the settlement of the Sirsa district, *vis.*, that the Hakra is not large enough to have carried the waters of the Sutlej. I will quote Mr. Wilson's own words: "The Sotar is a well-defined valley, varying in width from three to six miles, of no great depth, and usually quite level from side to side, but distinctly marked off from the light-coloured loamy soil of the plain through which it passes by a clearly defined bank or sand-ridge on either side, and still more by its dark rich clay soil free from admixture of sand and producing a vegetation different in character from that of the surrounding country."

\* \* \* "From the appearance of the Sotar valley and the numerous remains of towns and villages which stud its banks all the way to Bhawalpur,\* it is evident that at one time it conveyed a much larger volume of water than at present, and probably was the channel of a perennial stream. But though it must have been, as it is now, the largest and most important of all the drainage channels between the Sutlej and the Jumna, it can never have carried a river at all approaching in size to either of these two. The valley is too shallow and shews too few marks of violent flood action for this to have been the case; and there is none of the river sand which would certainly have been left by such a stream. The soil is all rich alluvial clay, such as is now being annually deposited in the depressions which are specimens of those numerous pools which have given the Saraswati its name, 'The river of Pools'; and there seems little doubt that the same action as now goes on, has been going on for centuries, and that the numerous mountain torrents of the Indo-Ganges watershed, fed, not by the snows but by the rainfall of the Sub-Himalayan ranges, wandering over the prairie in many shallow channels, joined in the Sotra or Hakra valley and formed a considerable stream, at first perhaps perennial but afterwards becoming absorbed after a gradually shortening course, as the rainfall decreased over the lower Himalayan slopes, and as the spread of irrigation in the submontane tract intercepted more and more of the annual floods; and the comparatively feeble stream, cutting away all the promineney in its bed, deposited the silt in the depressions, and gradually filled its valley with a level layer of rich hard clay. The same process appears to be still going on, and the bed of the stream is gradually attaining one uniform slope throughout."†

\* Mr. Wilson had traced its course outside the Sirsa district on native authority into the Garrah near Bhawalpur. Actual survey has shewn that this information was erroneous.

† Final report of the Revision of the Settlement of the Sirsa District in the Punjab, by J. Wilson, Settlement Officer, Calcutta, 1884.

I have quoted this passage as giving a clear statement of the nature of the objection raised, *viz.*, the shallowness of the channel and the difference of its soil from the sandy silt found in the present bed of the Sutlej, and at the same time describing the manner in which it is even now being filled up with an alluvium precisely similar to the existing soil, and different from the sandy silt of the present bed of the Sutlej, thus destroying the objection just urged so forcibly. There is no evidence of the progressive diminution of rainfall assumed by Mr. Wilson, but the other reason—the extension of irrigation—would certainly absorb an increasing proportion of the water, and may account for the fact that the waters of the Gaggar appear to have reached further down this channel about the commencement of the present century than they now do.

Another objection which has been raised is, that the Sutlej flows in a depression below the level of the plain over which the Sotar pursues its course, and that neither it nor any of the dry river channels, to be mentioned further on, which communicate with it have been traced into connexion with the Sutlej. As regards the first, this is a common characteristic of all the rivers of the Indo-Gangetic plain, and it is certain that, as long as the present conditions existed, it would be impossible for any great changes in their courses to take place. But it is equally certain that, when these plains were being formed, the rivers must have wandered over them in channels raised above the general level of the surface, and were consequently liable to constant change of course, and that the present configuration is due to a change of conditions, from one of deposition to one of erosion by the rivers, the exact date or cause of which has not been established.

With regard to the second objection, it implies an ignorance of the conditions under which rivers flowing over an alluvial plain may change their course. In such cases rivers flow in places in a single well-defined deep channel, but in others they spread out over a shallow ill-defined bed or even split up into several distinct channels; it is at such places as this that a river is liable to break away into lower ground on either side, the shallow channel becomes obliterated and gradually merges into the general level of the plain, but lower down, where the river flowed in a deeper and better defined channel, the dry bed remains distinguishable and marks the former presence of the river.

§ 3. We must now consider the historic evidence in favour of or against the supposition that there have been extensive changes in the course of the Sutlej during the historic period.

In the Vedas, the Sutlej is several times mentioned under the name

of Satadru, but only in one case is it mentioned or supposed to be mentioned in connection with the Beas, and that is the 33rd hymn of the 3rd Mandala, where the confluence of the Ohutudri and the Vipas is referred to; there are, however, some points in the description which render it open to doubt whether this refers to the confluence of the Sutlej and Beas, and, moreover, it would not prove that the Sutlej did not pursue an independent course at a subsequent period, unless we could also prove that the present configuration of the ground, the distinction of Khadir and Bhargar, of strath and upland, existed in Vedic times.

Coming to a later period, we do not find the Sutlej mentioned by any of the classic historians or geographers. In Arrian's *Anabasis* there is no mention of the Sutlej, though all the rivers, from the Indus to the Beas, are mentioned, and, in the description of his voyage down the Jhelum and Indus, we find the statement that "these four large and navigable streams at last discharge their waters into the Indus, though they do not preserve their individual names until that time. The Hydaspes falling into the Akesines loses its name there, the Akesines takes in the Hydraotes and also the Hyphasis, and retains its name until it falls into the Indus."\* Here not only is there no mention of the Sutlej, but the special mention of *four* rivers shews that there was no information extant of the existence of a fifth large river.

In the "*Indica*" of Arrian some other rivers or streams are mentioned; it is there stated that the "Hydraotes, flowing from the dominions of the Kambistholi, falls into the Akesines after receiving the Hyphasis in its passage through the Astryabai as well as the Saranges from the Kekians and the Neudros from the Attakenoi."†

Ptolemy, however, mentions a river Zaradros which he makes to receive the Bibasis (Beas) much in the same place as the junction takes place at present, and furthermore he makes it preserve its name right to the Indus. He also makes the Bidaspes (Jhelum) preserve its name till it joins the Zaradros, although it receives first the Sandabal (Chandrabagha or Chenab) and then the Adris (Ravi). With the exception of a few slight peculiarities of nomenclature, this is practically the same arrangement as obtains at the present day, if we may regard the Zaradros as the Satadru or Sutlej of modern times; and when we find the greatest of the classical geographers agreeing so closely with our modern maps, we may well begin to doubt whether there has been any great change in the course of any of the rivers since his time.

Ptolemy, however, gives one peculiar piece of geography which must not be passed over without notice; in latitude 29° 30', or about

\* *Anabasis*, LVI, OXIV.

† *Indica*, cap. IV, McCrindle's Translation, p. 190.

thirty miles south of the junction of the combined rivers, he places a "divarication of the Indus towards Mt. Onindion" and the "source of the divarication" in Lat.  $27^{\circ}$ , Long.  $127^{\circ}$ . This, allowing for the vagaries of Ptolemy's geography, would agree fairly well with the commencement of the Sotar, and it may be noticed that many maps which profess to shew the ancient geography of India make the "Neudrus" follow the course of the Sotar for some way and join the Indus about where Ptolemy places this divarication. It is not necessary here to enter into a discussion of the exact meaning of that extraordinary phrase of Ptolemy's "*ἡ πηγὴ τῆς ἀκτροπῆς*," for it is evident that in this matter he was given to a looseness of language, or an inaccuracy of information, which led him to confuse together affluents and effluents, tributaries and distributaries.\*

After Ptolemy, a long night fell upon our knowledge of India, and, when, with the advent of the Arab invaders, the dawn again begins to lift, we find much that is with difficulty reconcilable with Ptolemy's account. We have firstly the marches of Chach and Muhammad Kasim from Aror to Multan, in both of which the "Biyas" is the first river crossed after leaving Arore, thus ignoring the "divarication towards Mount Onindion" of Ptolemy; but a far more noteworthy fact is that, throughout the chronicles translated in the first two volumes of Sir H. Elliot's History of India, the name "Biyah" is invariably applied to the combined Beas and Sutlej rivers. It is needless for me to give instances in detail, for they are numerous, and many of them have already been quoted by the anonymous reviewer so frequently referred to.† The only mention of the Sutlej by any of the historians that I can find is in the description of one of Mahmud's campaigns, where he is said to have crossed the Sihun (Indus), Jelam Chandraha, Ubra (Ravi), Bah (Beas) and Salladur (Sutlej); but, as it is also stated that all the rivers bear along with them great stones, he must clearly have crossed them near the foot of the hills, and consequently above any possible confluence of the Sutlej and Beas. Col. Tod, in his Annals of Rajputana, mentions that the same nomenclature is found in the native annals of the state of Jessalmer,‡ which formerly embraced the whole of what is now Bhawalpūr and Sind east of the Indus as far south as Arore.

So peculiar a nomenclature as this of the greater river losing its

\* *Ancient India as described by Ptolemy*, by J. W. McCrindle, M. A., M. B. A. S. London, Calcutta and Bombay, 1885, pp. 91 to 95.

† *Calcutta Review*, LIX, p. 11 *et seq.*

‡ *Annals and Antiquities of Rajasthan*, footnote to chapter V of the Annals of Jessalmer.

name in the lesser, where there is no special sanctity attached to the latter, can only be explained on the supposition that the Sutlej originally pursued an independent course, that it afterwards joined the Beas, and that the united rivers below their junction, retained the name which had originally been applied to only one, in this case to the lesser of the two.

Another indication that the Sutlej was not originally a tributary of the Indus is the existence of the word Panjnad as an old name of the Indus. This nomenclature is mentioned by Tod as occurring in the annals of Jessalmer\* and by the Arab geographer Al Biruni, who, writing in the eighteenth century, says that the Sind after passing Andar, (Aror) bears the name of Mihran, and adds, "In the same way as at this place they call the collected rivers 'Panjnad,' so the rivers flowing from the northern side of these same mountains when they unite near Turmuz and form the river Balkh (Oxus) are called the seven rivers." At the present day this term Panjnad is unknown as a name for the Indus, the corresponding name at present being Satnad, while Panjnad is confined to the Chenab below the confluence of the other rivers of the Punjab, and it seems incredible that so inappropriate a name could ever have been applied had the courses of the rivers been similar to what they now are.

These facts point to the conclusion that the Sutlej was not always a tributary of the Indus, but may have pursued an independent course at any rate to a point much below the junction of the other four rivers, and if this supposition is correct, the natural conclusion is that the Sotar, Hakra, or Wahind marks its ancient course through the Western desert.

§ 4. It remains to be seen how far the physical configuration of the ground supports this supposition. As I have already said, the dry bed of the Sotar can be traced as far as Tohana in the Hissar district, where, as is shewn by the disposition of the minor drainage that issues from the outer Himalayas between the Jumna, the point of junction of the two great fans of the Jumna and Sutlej respectively is situated. Under these circumstances it may have derived its waters originally from either the Jumna or the Sutlej or both.

But the Sotar is by no means the only dry river channel in this region. Between it and the Sutlej there are no less than four other dry river channels, all of which, if any trust may be placed in maps, vary from one to three miles in width, and all of them directly or indirectly join the Sotar. These channels are not marked, on any map I have seen,

\* *Annals and Antiquities of Rajasthan*, footnote to chapter I of the *Annals of Jessalmer*.



above where they enter the Sirsa district, but they can all be traced into communication with each other or with the Sotar. The most easterly of these is known as the Wah, and joins the Sotar fifteen miles from Bhatner; the other three are all known as Naiwal, the easternmost of these enters the Sotar near the ancient fortress of Bhatner, while the two westerly Naiwals, after uniting in Lat  $29^{\circ} 53'$ , Long  $73^{\circ} 53'$ , appear to join the Sotar at Wullur. As I have said, these channels are not marked on any map to the north of the limits of the Sirsa district, but, according to the writer in the *Calcutta Review*, the easternmost Naiwal was traced northwards, during the preliminary survey for the Sirhind canal, to Chumkour, ten miles from Rupar, the point where the Sutlej leaves the hills. The next of the Naiwals enters the Sotar at Wullur near the boundary of Bikanir and Bhawalpur, and has been traced upwards as far as the ancient fortress of Bhattinda, and, in the settlement report of the Ludianah district, there is a reference to an old river bed which may be traced from Muchowari to near Tulwandi (fifty miles north-east of Bhattinda) and thence onward to the south-west, in all probability these are continuous. The most western of these Naiwals may be traced upwards past Abohar and Marot, and is said to be clearly defined at the village of Urkari, twenty miles south-west of Ludianah and half that distance from the present course of the Sutlej.\*

None of the maps mark more than a single dry river channel as entering the Sotar from the east, and, on the most recent large-scale maps of the Sirsa district, this is not marked as recognizable in the same manner as the Sotar and the Naiwals, from this we may conclude that it has probably been deserted for a longer period than the latter. This channel is known as the Chitang or Chitrang, and, on the engraved thirty-two miles to an inch map of India, is conjecturally continued, till it joins the lower end of the drainage channel which derives its name from Feroz Sháh, who converted it into a canal by introducing the waters of the Jumna.

It will be seen from this that the old channels connecting the Sotar with the Sutlej are both more numerous and more recent than the solitary one, of any importance, which leads towards the Jumna, and we may conclude that, at any rate in the latest stage of its history, this lost river of the Indian Desert was the Sutlej.

I may add, though it cannot be regarded as evidence of much value, that the traditions of the district declare that these channels were in turn the bed of the Sutlej river †

\* *Calcutta Review*, LIX, 6

† *Calcutta Review*, LIX, 6. On the revenue survey maps of Bhawalpur the words "old bed of the Sutlej" are printed from south to north along the boundary of Bhawalpur, in the neighbourhood of Wullur.

§ 5. We have now seen that a dry river bed can be traced, practically continuously, from Tohana in the Hissar district to the Eastern Narra in Sind. We find that the drying up of this river cannot be due to diminished rainfall, and that we must consequently look to either the Sutlej or the Jumna for its supply; and, as the latter of these has been known to flow in its present course from the time of Manu downwards, while tradition and history alike point to the lost river having flowed at a much later date than this, we are perforce compelled to look to the Sutlej. We have seen that the supposed mention of the confluence of the Sutlej and Bias in the Vedas is not conclusive; that, though Ptolemy seems to take the former river into the latter much as is now the case, yet, when we come to the time of the Arab invaders of India, we find a peculiar nomenclature of the river, which points to the conclusion that the Sutlej can then only recently have become a tributary of the Bias and so of the Indus; and, moreover, we find a number of dry river channels, all of which lead from within a few miles of the present channel of the Sutlej, and ultimately join the dry bed of the lost river. Taking all these points into consideration, we may well conclude that this Lost River of the Indian Desert was none other than the Sutlej, and that it was lost when that river turned westwards to join the Bias.

III. *The Saraswati of the Vedas.* Probably the most difficult of all these problems relating to the rivers of Northern India is the persistent reference, in the Vedas, to the Saraswati as a large and important river. It is impossible to suppose that rational beings would have selected the insignificant streamlet, now known by that name, whose bed contains no water for a large portion of the year, to associate it on equal terms with the rivers of the Punjab and the Indus, still less to exalt it above them all, to describe it as "chief and purest of rivers flowing from the mountains to the sea", or as "undermining its banks with mighty and impetuous waves." The only conclusion open to us is, then, either that there has been some great change in the rivers of this region, or that the Saraswati of the Vedas has no connection with the insignificant streamlet which we now call by that name.\*

The latter of these two is the opinion adopted by Mr. E. Thomas† in an essay on the rivers of the Vedas. According to him, a part of the ancient Aryans, after leaving their native country at the head waters of the Oxus, remained for some time in the valley of the Helmund, references to which were incorporated in their sacred hymns. After a while

\* I have already shown that this change cannot be due to diminution of rainfall.

† *Jour. Roy. As. Soc.*, XV (new ser.), pp. 267—286 (1895).

they were again compelled to migrate, and, on reaching the Punjab, tried to revive the seven rivers of their original home; unfortunately, however, there were only six large rivers, but the Saraswati being a stream that lost itself in the lake or tank of Kurukshetra reminded them in a manner of the Saraswati they had left behind them, the name was transferred to it, and thus the seventh river was found. In favour of this hypothesis may be mentioned the fact that, in the Zend, the Helmund is called the Haraquaiti, a word identical with the Sanskrit Saraswati, according to the recognised rules of transliteration, but there is little else that can be produced in favour of this highly ingenious but far-fetched hypothesis. It implies an almost incredible degree of childishness in the ancient Aryans to suppose that they would confuse together a petty streamlet and a large, navigable river simply for the reason that the one ended in a large lake, while the other flowed into a tank or *jhal*.

§ 2 Rejecting the ingenious explanation of Mr Thomas, there is no alternative but a considerable change in the hydrography of the region. We may at once dismiss all suggestions of any possible change in the number or position of the large rivers within the limits of the Himalayan region, and, as all the rivers of the Punjab are accounted for, we need only consider whether the Jumna, or a portion of its waters, flowing in a channel different from the present one, may not have been the Saraswati of the Vedas.

The configuration of the ground west of the high bank of the Jumna is that of a very broad and gently sloping cone; this is clearly shewn by the general directions of the minor watercourses west of the Jumna, which, as a glance at a sufficiently large scale map will shew, radiate from the point where the Jumna leaves the hills. This feature can only have been produced by the Jumna itself, like the Sutlej, though now flowing in a depression below the general level of the plains on either side, having once flowed over their surface. The Jumna must, consequently, during the period which geologists call recent, have flowed sometimes into the Ganges and sometimes through the Punjab; but it is not possible for geology pure and simple to give the exact date at which the Jumna last changed its course.

Two of these now minor drainage channels, the present Saraswati and the Chitang, are continuous with the Sotar, and die out after approaching within a few miles of the old high bank of the Jumna; and it is not impossible that one or the other may mark approximately the course of the Jumna, or Saraswati, of the Vedic period.

In this connection, a coincidence may be mentioned which is per-

haps germane; when, about the commencement of the century, the Brahmaputra, a sacred river like the Saraswati, broke away from its old course and flowed west of the Madhopur jungle to join the Ganges, the new channel thus formed was immediately christened the Jamuna, a name it retains to this day, while the old channel now deserted by the main stream is still known as the Brahmaputra. Possibly, a similar explanation may be assigned to the name of the Jumna, which, originally known as the Saraswati, struck out a new course for itself during the Vedic period and, doing so, acquired a new name. If this be so, the native tradition that the old Saraswati joins the Ganges at Allahabad is, unwittingly, a true statement of fact.

The most weighty, and indeed almost the only, argument that can be urged against this hypothesis must be derived from the mention of both the Saraswati and the Jumna in the Vedas, and even in the same verse of the same hymn. It may have been, however, that the Jumna, after leaving the hills, divided its waters, as the Diyung does even now in Assam, and that the portion which flowed to the Punjab was known as the Saraswati, while that which joined the Ganges was called the Yamuna. Possibly this was the hydrography of the country when the Aryans entered India, but the name Yamuna seems to indicate that the easterly flow of the Jumna was established subsequently to their arrival; the silence of the Vedic hymns on this point is not an objection of importance, for the geographical references they contain are few and far between, almost invariably incidental, and seldom go beyond the mere mention of a name.

The above is confessedly but an hypothesis, and is probably incapable of proof or disproof, yet it is one which has been proposed by Mr. Fergusson, who, if not a Vedic scholar, was, at any rate, a careful observer of the mode of action of rivers, and whose essay on the delta of the Ganges is still the standard authority on the physiography of rivers flowing through alluvial plains. If not true, it is at least a possible explanation of the difficulty whose solution is by no means a matter of purely antiquarian interest, for, if the explanation I have put forward is the true one, it is evident that the present distinction between *bhangar* and *khadir* has originated since the Aryan immigration, and, as it is hardly probable that there has been a sufficient change of level since then to account for the erosion by the rivers which has taken place, we must suppose it to be due to the extension of cultivation in the hills, which, by causing the rain to flow more quickly off the hill-sides, has augmented the violence, and consequently the erosive power, of the rivers when in flood, and thus caused them to lower their channels into the plains over which they flowed.

united, are usually free. The perianth sometimes hardly covers the stamen or stamens; in other cases it is large, inflated, and completely envelopes the stamen. In some species the pieces of the perianth are thin and colourless, and not unfrequently hyaline; in others they are of a red or dark-brown colour and opaque. In quite half the Indo-Malayan species there is only a single stamen; in very many there are only two; while in only a few are there so many as three. In shape the anthers are for the most part ovate or elliptic, although some are very broad and almost rotund; they are always 2-celled and have sutural dehiscence. Some are sessile or nearly so, and in very few is the filament long. The attachment of the anther to the filament is innate in most species; in a few, however, it is adnate. In species with two stamens the filaments are often united for the whole or part of their length, leaving the anthers, however, free.

"Pseudo-hermaphrodite flowers occur in only a few species. Such flowers have a perianth like the male flowers, but along with the single stamen there is present in them a pistil with completely formed style and ovary. I have, however, never found one of these ovaries to contain a seed, but I have not unfrequently found one containing a larva."

"Neuter flowers are found only in the few species forming the section *Synoecia*. They are long-pedicillate, have a 3-leaved perianth, and are without any trace of either anther or pistil.

"Fertile female flowers have a perianth not very different from that of the males, but consisting in many cases of more pieces, and being more often gamophyllous. In the case where the pieces of the perianth are free, the individual pieces are sometimes rather easily detached, and are very apt to be confounded with the bracteoles of the receptacles in species where the latter exist. The perianth is usually much smaller than the mature achene, and covers the latter very incompletely or not at all. In some cases where the perianth is gamophyllous it forms a small cup, which surrounds only the base of the ovary or its pedicel. It was in some such cases, where the perianth is hyaline, that Miquel was led to believe that none existed; and hence his statement about the perianth being absent in *Covellia*. The pistil may be sessile, but it is very often pedicillate; the ovary is more or less ovoid or obovoid, with a tendency to be emarginate on the side at which the style is attached. It contains a single pendulous ovule. The style is filiform, and is in most cases distinctly lateral or sub-terminal: it rarely springs from the apex of the ovary. In length the style usually greatly exceeds the ovary: it is usually smooth, but in a few species it is hairy. The stigma, which is papillose, varies in shape, being cylindric, clavate, peltate, or infundibuliform; and in a few cases it is flat. In many species it is oblongate,

truncate, and in not a few bicrural. It is, however, often very difficult to determine the exact form of the stigma, from the fact that at an early stage the stigmas of the fertile female flowers of the same receptacles are joined together in a dense felted mass, from which it is nearly impossible to detach any individual in a state of entirety. After fertilisation, the ovary becomes developed into an achene which tends to be unilaterally emarginate (many achenes are very distinctly reniform), and the style becomes more lateral, or even basal. The ripe achene has a crustaceous pericarp of a pale yellow colour and with a more or less minutely tuberculate or undulate surface. External to the crustaceous coat, there is occasionally a glairy or viscid layer. The pericarp is never very thick, and sometimes it is conspicuously thin. On cutting the achene open the embryo is seen with a small amount of albumen. I have not, however, paid much attention to the relation of the albumen to the embryo. Not a few of the perfect female flowers fail to be fertilised. But the fact of the barrenness of such is not recognisable until the achene has been cut open, and they are found to contain no embryo. Externally these infertile achenes exactly resemble those containing embryos.

"Besides the above four kinds of flowers, there occur, in all the species of *Ficus* which I have examined, a set of flowers which, adopting the name given to them by Count Solms-Laubach, I call *gall* flowers. My own name for these was originally *insect-attacked females*; but Count Solms-Laubach's name being much shorter and more suitable, I have adopted it. The existence of these gall flowers, as a separate and distinct kind of flower in this genus, was first made publicly known by the distinguished botanist just mentioned, in *Botanische Zeitung*, Nos. 33 to 36 for 1885. My own observations and inquiries on *Ficus* have been in progress since 1878, but on account of my unwillingness to publish anything until I had completed my research, I have been anticipated in the publication of the facts about gall flowers. The gall flowers in many respects resemble the fertile female flowers: they have in most cases a similar perianth, an ovary, and a style. When fully developed, they are recognised at a glance by their containing the larva of an insect, which can often be seen through the pericarp of the false achene into which the ovary develops. But whether the larva be visible or not, or whether it be present or not, the false achene of the gall flower may, in its later stages, be distinguished from the true achene of the fertilised ovary of the perfect or fertile female flower by being more often pedicellate, and by its shape being usually globular and rarely elliptic or reniform; by its surface being smooth, not minutely tubercular or undulate, and never viscid or glairy; and frequently also by the taste,

distended appearance of tough membranous wall (false pericarp). The style is, as a rule, much shorter and straighter than the style of the fertile female flower, and more terminal; and it has very frequently a dilated tubular apex which occupies the situation of the true stigma, but has often little or none of the viscid parenchyma characteristic of that organ. These peculiarities in the nature of the stigma and the shortness of the style are apparent in the gall flowers of many species from a very early stage. They are not consequences of the deposit of the egg of an insect in the ovary, but, as Count Solms-Laubach points out (*Bot. Zeitung*, 1 c.), such original peculiarities in the style and stigma of the gall flower may rather determine the selection of it by the insect as the nidus for its egg; for in many of the species of *Blastophaga* and of some other Hymenopterous genera which visit figs, the ovi-positioners are not long enough to reach down the longer and more curved styles of the perfect female flowers. There are, however, many species of *Ficus* (more especially in the group *Urostigma*) in which the gall and fertile female flowers are not characterised by any marked differences in the form of style and stigma, and it is only by cutting the ovaries open that the two can be distinguished.

"Now there is probably nothing in itself very remarkable in the mere occurrence in the genus of numerous flowers having the general form of females, which yet, by reason of certain peculiarities in their structure, are incapable of fertilisation by pollen and are practically barren, while at the same time their very structural defects fit them for becoming the nidus for the eggs of special insects. But when the manner in which these malformed female flowers are disposed in the receptacles is inquired into, it becomes clear that, through the interposition of insects, these malformed females play a most important part in the life-history of many species of the genus. In all the species, except those included in the section *Urostigma*, the gall flowers occupy the same receptacles as the males, while the fertile female flowers occupy different receptacles. In other words, the majority of the species have two distinct sets of receptacles—one set containing male and gall flowers, but no fertile female flowers, and another set containing only fertile female flowers without any trace of either male or gall flowers. The proportion of males to gall flowers in receptacles of the former kind varies. In all (excepting the *Urostigmas* just mentioned) it is the rule to find the males confined to a zone of greater or less width at the apex of the receptacle just under the scales which close its mouth. Sometimes this zone is very narrow indeed, and consists of only a single row of male flowers, and that row not always a complete one; the remaining part of the interior of the receptacle being occupied by gall flowers.

By far the majority of cases these two kinds of receptacles, so physiologically distinct, are undistinguishable by external characters, and they are both borne by the same individual plant. They look exactly alike until one cuts them open and examines their contents. The most notorious of the few exceptions to this rule is the common eatable fig (*Ficus Carica*), in which species the male and gall flowers occupy elongated receptacles borne on one set of individual trees, while the fertile female flowers occupy more or less globular receptacles which are borne by a different set of trees. So different in appearance are the two kinds of receptacles in *F. Carica*, that the trees bearing them (although they have similar leaves) have almost from time immemorial been considered distinct species, known by distinct names—the former being called the Caprifig, the latter the Fig.

"In the majority of the gall flowers an insect deposits an egg, and many of them contain a larva which is easily seen through the coats of the false achene. The larva escapes into the cavity of the receptacle by cutting its way through those coats, and the fully developed winged insects are often to be found in considerable numbers in the cavity of the fig, the opening by which each escaped from the ovary in which it was developed being clearly visible. The perfect insects escape from the cavity of the receptacle into the open air by perforating a passage through the scales that close the mouth of the latter. The egg of the insect must in most cases be deposited in the ovary of the gall flower at a very early period; for, about the time at which the pupa is escaping from the ovary, the pollen of the anthers of the male flowers is only beginning to be shed. It is quite clear therefore that the synchronism of the two events—the escape of the insect and the maturity of the pollen—is an arrangement of much physiological significance. In the species of *Ficus* in which the arrangement just described obtains (and these are by far the majority), the perfect female flowers are contained in receptacles which are consecrated to themselves alone. In these receptacles the flowers are all perfect females. There is not a trace of a male or of a gall flower. These receptacles in many species are perfectly closed from a very early stage, and yet, in the majority of cases, every one of the ovaries of the females they enclose contains, when mature, a perfect embryo. The exact way in which these females are pollenised is a matter on which I cannot pretend to throw any light. I can only state the problem. The males are shut up from an early age with a number of females, the structure of whose organs is unfavourable to pollenisation. No pollen is produced by the males that are shut up with these females until all possibility of their becoming fertile with pollen has been precluded by the deposit within each of them



ovarial cavities of the egg of an insect. On the other hand, a number of perfectly formed females, all well adapted for the reception of pollen, are shut up together in a receptacle which contains neither male nor gall flowers, and to which it must from a very early stage be very difficult for pollen-bearing insects to get access. Yet each of the females situated in such apparently disadvantageous circumstances bears a well-formed embryo. No doubt the *Blastophaga* or other Hymenopterous insect developed in the gall flowers, in some way, conveys the pollen of the males to the perfect females imprisoned in the neighbouring receptacles. But although one can understand that it is to the advantage of the insect to enter the receptacle containing the gall flowers, since these afford it such a suitable nidus for its egg, and that the mature insect in escaping from these receptacles may, inadvertently carry along with it some of the pollen which the anthers are then shedding, yet it is difficult to understand how the pollen so removed is conveyed into the interior of the receptacle containing the perfect female flowers, and how these females are so universally fertilised by it.

"This arrangement, by which the receptacles are practically diocious, obtains, as I have said, in a large proportion of the species of *Ficus*. There is, however, a group of species (*Urostigma*) in which it does not obtain, and in which male, fertile female, and gall flowers are contained in the same receptacle. In this group the difference in structure in the early stages between gall and fertile female flowers is very slight, and in some cases I could find no difference whatever. And even the ripe achenes of the fertile females are in many cases undistinguishable externally from the ovaries containing far advanced pupae, and it is only by cutting them open that they can be recognised. As regards the relation in this group of *Urostigma* of the male flowers to the fertile female and gall flowers, there are two types of arrangement. In one set of species (of which *F. Bengalensis* and *tomentosa* are good examples) the male flowers are comparatively few in number, and are confined to a zone at the apex of the receptacle, just under the ostiolar scales; while in another set the male flowers are intermixed with the fertile female and gall flowers over the whole surface of the interior of the receptacle.

"A third small group (*Synæcia*) has neuter flowers mixed with the fertile females in one set of receptacles; while the other set of receptacles contain only male and gall flowers. And a fourth group (which I have named *Palaomorphe*) has male flowers which, in addition to an anther, contain an insect-attacked or gall pistil. These pseudo-hymenophrodite flowers are confined to the sub-ostiolar zone, the remainder of the receptacle being occupied by gall flowers: while perfect females

flowers occur in a distinct set of receptacles and are unaccompanied by any trace of male or gall flowers.

"It appears to me that, in the peculiarities in the structure and arrangement of the flowers which I have above described, the evolutionary history of the genus *Ficus* may to some extent be traced. I have therefore ventured to arrange the Indo-Malayan species into two great groups, and to divide the second of these great groups into three sub-groups, according to their presumed seniority. Believing that hermaphroditism is an archaic and primitive condition from which the genus is in process of delivery, I look on its persistence, even in an imperfect form, as an indication of age. I have therefore separated off the ten species in which I find it regularly to occur into a distinct group. Of this group pseudo-hermaphroditism is the diagnostic mark; and to the section which these ten species form I have given the name *Palæomorphe*. It is true that, in the whole of these ten species, the pseudo-hermaphrodite flowers are confined to the same receptacles as the gall flowers; while the perfect females are confined to a distinct set of receptacles in which there is no trace of either males or galls, and that the receptacles are thus practically dioecious. Still it appears to me that the persistence of the rudimentary female organ in the male flowers must be taken as indicating a more primitive condition than the enclosure in the same receptacle of strictly unisexual male and female flowers (the arrangement obtaining in *Urostigma*). These ten species being disposed of in a group by themselves, I have formed the remaining species of Indo-Malayan *Ficus* into a group characterised by unisexual flowers. And that group I have divided into three sub-groups, according as the receptacles are monœcious, pseudo-monœcious, or practically dioecious, the practically dioecious sub-group being again subdivided into sections which are founded on the number of the stamens and the situation of the receptacles. For five of the seven sections into which I have thus thrown the Indo-Malayan species, I have adopted, as sectional designations, words previously in use as sectional or subgeneric names. For the first section, as already stated, I have invented a new name, which indicates what I believe to be its position in the evolution of the genus, and for the seventh I have also invented a name, indicating its juniority in point of evolution. The arrangement is as follows:—

**GROUP I.—PSEUDO-HERMAPHRODITE**; male flowers with 1 stamen and a rudimentary pistil.

Pseudo-hermaphrodite flowers and gall

flowers in one set of receptacles:

fertile female flowers in another set *Palæomorphe*.

**GROUP II.—UNISEXUAL OR ASEXUAL**; male flowers without rudimentary pistils.

- SUB-GROUP I.—Male, gall, and fertile female flowers on the same receptacle ... *Urostigma*.
- SUB-GROUP II.—Flowers unisexual or neuter: male and gall flowers in one set of receptacles, fertile female and neuter flowers in another set ..... *Synaoia*.
- SUB-GROUP III.—Flowers unisexual: male and gall flowers in one set of receptacles, fertile female flowers only in another set—
- A.—Flower monandrous—
- a, Receptacles chiefly axillary ..... *Sycidium*.
- β, Receptacles mostly in fascicles from stem and branches ..... *Ouvellia*.
- B.—Flowers di-, rarely triandrous—
- a, Receptacles mostly axillary ..... *Eusyce*.
- β, Receptacles mostly in fascicles from stem and branches ..... *Neomorphe*.

Amongst the new species which it is the chief object of this paper to describe there are none belonging to the sections *Palæomorphe* or *Neomorphe*. The species are as follows:—

**UROSTIGMA.**—Male, fertile female, and gall flowers in the same receptacle; stamen usually 1; stigma elongate, usually acute; receptacles in the axils of the leaves or of the scars of fallen leaves, tribracteate at the base; leaves alternate, entire, coriaceous, or sub-coriaceous, rarely membranous; usually trees or powerful climbers; epiphytal at least in early life.

*Ficus hesperidiiformis*, King; a tree, glabrous in all parts except the stipules which are minutely tomentose externally; young branches hollow, thick, marked with annular scars; leaves coriaceous, alternate, broadly elliptic-oblong, gradually tapering towards the apex which ends in a short rather blunt point, the base rounded, edges entire; lateral primary nerves very numerous (40 or 50 pairs) running nearly at right angles from the thick prominent midrib and anastomosing about .1 in. from the edge, secondary nerves and reticulations minute but distinct, the petiole from  $\frac{1}{2}$  to  $\frac{3}{4}$  as long as the blade; stipules very large, coloured, convolute, minutely tomentose on the outer, smooth on the inner surface;

length of blade and of stipules 6 to 9 in., petioles 2·5 in. to 4·5 in.; receptacles large, axillary, solitary, pedunculate, globose, smooth, apparently without basal bracts, about 1·5 in. in diam., the walls very thick; male flowers numerous, pedicellate, anther single, sub-sessile, ovoid, its walls thick and cartilaginous, the dehiscence lateral, perianth gamophyllous with 3 oblong blunt segments; gall flowers with hard, crustaceous, 3-sided ovary, thick short pedicel, and no perianth other than the long, linear, subulate scales which spring from the walls of the receptacle between the flowers; fertile female flowers not seen.

New Guinea; H. O. Forbes, No. 737.

The material in my possession is not very abundant, and I have not had the advantage of seeing Mr. Forbes's field notes. I presume this is a tree. The leaves and stipules at once recall to mind those of *F. elastica*. But the leaves of this are larger and the stipules are tomentose externally. The receptacles are quite different from those of *elastica*, being greatly larger and of a globular, not an ovoid, shape. When dry, the receptacles a good deal resemble a small orange.

*Ficus Edelfeltii*, King; a tree, the bark of the young shoots pale and slightly puberulous, all the other parts glabrous except the midribs of the leaves and the receptacles; leaves alternate, thinly coriaceous, shortly petiolate, from oblong to obovate-elliptic, gradually narrowed to the rounded 5-nerved base, the apex rather suddenly contracted to a short blunt acumens, the edges entire and slightly undulate; primary lateral nerves about 9 pairs, prominent on the lower surface and forming bold intramarginal arches, the midrib prominent, sparsely adpressed-pubescent; the rest of the lower surface glabrous and shining, the minor nerves and reticulations strongly marked; upper surface dull, darker than the lower; length of blade 6 to 8 inches, width 3 to 3·25 in.; petioles ·5 in. long; stipules slightly shorter than the petiole, lanceolate, convolute; receptacles axillary, in pairs, pedunculate, globular, with a projecting cylindric pubescent umbilicus, the sides pubescent when young, nearly glabrous when adult, from ·6 in. to ·75 in. in diam., basal bracts 3, small, reflexed; peduncle about ·1 in. long, tomentose; male flowers only near the mouth of the receptacle, sessile, the stamen elliptic, on a short thick filament, perianth of 5 narrowly semi-lunar pieces; gall flowers with a globular smooth, thin, naked ovary and a short lateral style, the perianth like that of the male; fertile female flower with an ovoid, rather flattened, minutely tuberculate achene, and a filiform lateral style much longer than the ovary, the stigma triangular, perianth of 4 broadly semi-lunar pieces.

New Guinea, H. O. Forbes, No. 59, and probably also 409, of which I have not complete specimens.

In foliage this species much resembles the Indian *F. nervosa*, Heyne; but the receptacles of this are much larger. Its nearest ally is, however, *F. pubinervis*, var. *Teymanni*, which it almost exactly resembles in the form, texture, and nervation of its leaves. The flowers, however, of the two differ, and I have no doubt they are distinct species.

*Ficus Lawesii*, King; a tree, all its parts quite glabrous, the bark of the young shoots pale and shining; leaves petiolate, thickly membranous, ovate-oblong or narrowly elliptic, entire, the base rounded 3-nerved, the apex gradually narrowed to a very short blunt point; lateral primary nerves diverging from the bold midrib at a wide angle, about 10 pairs, not very prominent on either surface, the reticulations small and rather distinct on the lower surface; both surfaces quite smooth but rather dull when dry, length of blade 5 to 6 inches, width 2.5 in.; petiole 1 in. to 1.25 in., stipules narrowly lanceolate, convolute, rather more than half as long as the petiole; receptacles crowded near the ends of the branches, in pairs, sessile, cylindric-globose, .5 in. in diam., contracted at the base into a short thick pseudo-stalk, umbilicus composed of 3 large, thick smooth triangular scales, the sides smooth; basal bracts coalescing into an irregular ring; gall flowers sessile, the ovary prismatic, conical, smooth, style and stigma absent: male and fertile female flowers unknown.

New Guinea: H. O. Forbes, No. 85. From its general *facies*, I have no doubt that this is a *Urostigma* near *nervosa*. The receptacles, however, in the only two specimens I have seen, are discused; and only the gall flowers can be distinguished.

I have named this after the Rev. W. G. Lawes, one of the devoted band of missionaries settled on the south-eastern coast of N. Guinea who have done so much in the way of collecting.

*Ficus casearioides*, King; a glabrous tree, the leaves on long petioles, thinly coriaceous, alternate, entire, broadly ovate-elliptic, tapering much to either end, the base acute, 3-nerved, the apex suddenly and shortly triangular-acuminate; lateral primary nerves 8 to 10 pairs, nearly at right angles to the midrib and like it strongly marked on the under surface, which is minutely tuberculate-tesselate; length of blade 5 to 6.5 in., breadth 2.75 in. to 3.25 in., petiole 1.5 in.; stipules lanceolate sub-convolute, .6 in. long; receptacles axillary, in pairs, on long slender peduncles, .5 in. in diam., depressed globular with a slight stalk-like construction at the base, smooth, basal bracts 3, minute; peduncles .75 in. long; male flowers sessile, the single anther broadly ovate, sub-sessile; the perianth of 3 obovate pieces: gall flowers sub-sessile or pedicillate, the ovary smooth with thick crustaceous walls, the style short, lateral; the stigma infundibuliform; perianth of 4 or 5 oblong pieces which closely

invest the ovary; female flowers like the galls but with a shorter more globose ovary and a longer style: all three kinds in the same receptacle.

New Guinea, H. O. Forbes, No. 568.

The leaves of this a good deal resemble those of *F. cassaria*, Mull., but the structure of the flowers is different. The affinities of this in the section *Urostigma* are with *nervosa*.

SYNOECIA.—Flowers unisexual or neuter: male flowers with 1 stamen: male and gall flowers in one set of receptacles, fertile female and neuter flowers in another set; climbers with large coloured receptacles, the leaves tessellate beneath.

*Ficus Scratchleyana*, King; scandent, glabrous except the receptacles which are minutely sub-tomentose; leaves petiolate, coriaceous, entire, narrowly elliptic-oblong, gradually tapering to either end, the base minutely cordate, 3-nerved; the apex with a short blunt point; under surface tessellate; primary lateral nerves 5 or 6 pairs, prominent beneath, as is the midrib; length of blade 5 to 7 in.; width 1.75 in. to 2.25 in.; petioles 1 in. to 1.5 in. long; stipules subulate, convolute, about .5 in. long; receptacles axillary, solitary, pedunculate, ovoid-globose, minutely sub-tomentose, with a prominent umbilicus, about 1 inch in diam., basal bracts 3, small; fertile female flowers pedicellate, the perianth of 4 linear pieces, ovary ovoid-elliptic, the stylo lateral; stigma large, bicurled when young, truncate when adult from the absorption of the arms; neuter flowers mixed with the females all over the receptacle, pedicellate, the perianth of 4 lanceolate pieces: receptacles containing male and gall flowers not seen.

New Guinea, H. O. Forbes, No. 900.

This is well distinct from any other species of this group. Its nearest ally is *F. apicarpa*, Miq.

SYCIDIUM.—Flowers unisexual: male and gall flowers in one set of receptacles; fertile female flowers in a distinct set of receptacles; male flowers with 1 stamen (sometimes 2). Leaves alternate; receptacles small, axillary, more or less scabrid (a few have receptacles in fascicles from the stem); shrubs, small trees or climbers; rarely epiphytal.

*Ficus Armiti*, King: a climber; the young shoots covered with short, buff-coloured tomentum; leaves alternate, shortly petiolate, membranous, ovate-lanceolate, with a long acuminate apex, the base rounded or sub-cordate 5 to 7-nerved, the edges entire; primary lateral nerves 5 to 7 pairs, diverging from the midrib at rather a wide angle, lower surface minutely tuberculate, hispid especially on the midrib and nerves, the longer hairs with black enlarged bases; upper surface scabrid, the midrib minutely hispid; length of blade 2.5 in. to 3;

breadth 1.25 in.; petioles .2 in. long, tomentose; stipules, 2 to each leaf, subulate, rather longer than the petioles, tomentose at first, but ultimately glabrous; receptacles axillary, solitary, pedunculate, sub-globular, with rather a prominent umbilicus, shortly, hispid-tomentose when young, glabrescent when mature, .2 in. to .25 in. in diam.; basal bracts none, but a few irregular broad fleshy bracts along the sides; peduncles slender, about .2 in. long, tomentose; male flowers numerous near the mouth of the receptacle, the perianth of 3 lanceolate pieces; anther single, broadly ovate, on a long stout filament; gill flowers with a pedicillate gamophyllous perianth which is deeply cleft into 4 linear curving lobes which embrace the ovoid, smooth, shining ovary: style lateral, from near the apex of, and half as long as, the ovary; stigma infundibuliform; female flowers unknown.

New Guinea; H. O. Forbes, No 609. This species approaches *F. ampelias*, Burm., but its leaves are more inclined to be cordate at the base and acuminate at the apex, and they are less scabrous and more hairy on the under surface, while the receptacles are larger, more hairy when young, and on longer peduncles, than in that species.

I have named this after Mr. Armit, of the *Argus* Expedition for the exploration of New Guinea.

COVELLIA.—Flowers unisexual; male flowers in the same receptacles as the gill flowers, monandrous, the perianth of 3 or 4 distinct pieces; female flowers in separate receptacles from the males and galls, pedunculate or sessile, the perianth gamophyllous, much shorter than the ovary, or wanting, (rarely consisting of 4 or 5 pieces); the receptacles on long sub-aphyllous branches issuing from near the base of the stem, often sub-hypogæal; or on shortened branchlets (tubercles) from the stem and larger branches; or axillary: shrubs or trees, never epiphytes or climbers.

*Ficus Miquelii*, King: *F. caulocarpa*, Miq. in Ann. Mus. Lugd. Bat. iii, 235, 297 (not *Urostigma caulocarpa*, Miq. in Lond. Journ. Bot. VI, 568); *F. fistulosa*, Kurz (not of Reinw.), Forest Flora B. Burmah, II, p. 459, (partly): a tree, the young branches adpressed-strigose; leaves alternate or sub-opposite, membranous, obovate-oblong or oblanceolate, the apex suddenly contracted into a narrow tail about 1 inch long, edges entire, base much narrowed 3-nerved; lateral primary nerves 6 to 8 pairs forming an obtuse angle with the midrib; both surfaces pubescent when young, becoming when adult almost glabrous; length of blade 4.5 to 8 inches; petioles from .3 to .5 in.; stipules lanceolate, pubescent externally, .35 in. long; receptacles borne on rather large, panicled, scurfy, shortly bracteolate branches, which issue from the stem, pedunculate, depressed-globular, pubescent, greenish when ripe and with

pale stripes, about .75 in. across; umbilical scales numerous, rather broad; basal bracts 3, ovate-acute; peduncles .75 in. long; male flowers only near the ostiole, sessile, the perianth inflated, of three broadly ovate much imbricate pieces; anther broadly ovate, its apex emarginate, sub-sessile; gall flowers sub-sessile or long-pedicillate, without perianth, the ovary ovoid-globose, smooth; style short, lateral; stigma tubular; fertile female flowers without perianth, pedicillate, the achene obovoid, minutely tuberculate; style as long as ovary, lateral; stigma, cylindric. Celebes, De Vriese; Singapore, King; Sumatra, Beccari; (Becc. Herb, P. S. Nos. 544, 631, 761); Perak, King's Collector, Nos. 1883, 955; Burmah, Kurz, No. 1520, 3145; New Guinea, Forbes, No. 903.

This species is allied to *F. botryocarpa*, Miq. by the short, much branched receptacular panicles. This is the plant which Miguel described as *Covellia caulocarpa*; but as he had already described a *Urostigma caulocarpa*, it became necessary to find a new name for this, and I have taken the opportunity of re-naming it after that distinguished botanist.

*Ficus Chalmersii*, King; a tree, the young shoots slightly swollen at the nodes, the bark dark brown with short pale adpressed hispid hairs: leaves alternate, thickly membranous, ovate-lanceolate to ovate-oblong, tapering gradually to the slightly unequal, bluntish or sub-acute, 3-nerved base, and to the sharply, but shortly acuminate, apex; the edges entire or obscurely and remotely sub-serrate; primary lateral nerves about 7 pairs, minutely adpressed-hispid on both surfaces; the remainder of the lower surface of the leaf glabrous, of the upper surface minutely adpressed-hispid; length of blade 5 or 6 inches; petiole about .5 in. long, adpressed-hispid; stipules, in pairs, lanceolate, glabrous except a few stiff hairs near the base externally, .5 in. long; receptacles on short woody racemes from the stem and larger branches, pedunculate, in pairs, when young broadly pyriform with concave apex and much depressed umbilicus, smooth, .75 in. or upwards in diam.; basal bracts 3, broadly triangular, united into a cup; peduncle thick, about .25 in. long; female flowers (when young) narrowly ovoid-elliptic, the style short, thick, terminal, with a dilated discoid tubular stigma; the perianth gamophyllous, half as long as the ovary and closely applied to it; ripe female, male and gall flowers unknown.

New Guinea; H. O. Forbes, No. 100. A species near *brachiata*, King, but not so glabrous, and with its receptacles borne on much shorter branches than in that species.

Named after the Rev. J. Chalmers, the intrepid Missionary explorer of New Guinea.

*Ficus Bernaysii*, King: a tree? the young shoots fulvous-tomen-



tose: leaves alternate, shortly petiolate, membranous, inequilateral, obovate-elliptic, tapering gradually from above the middle to the bluish, very unequal, obscurely 5-nerved, base, and rather suddenly to the shortly acuminate apex, the edges minutely serrate; the whole of the under surface shortly fulvous-tomentose, primary lateral nerves 7 pairs; upper surface shortly adpressed-hispid, tomentose on the midrib and nerves; length of blade about 7 inches, petioles under .5 in.; stipules tomentose externally, glabrous internally, convolute, .5 in. long; receptacles on long peduncles, in short crowded panicles, from the stem and larger branches, puberulous, sub-globose, about .25 in. in diam., contracted at the very base into a short pseudo-stalk, at the junction of which with the peduncle proper are 3 small triangular basal bracts: peduncle proper nearly 5 in. long: young female flowers with a flattish ovoid, smooth, ovary; the style nearly as long as the ovary, lateral, curved, hairy, the stigma cylindric; perianth gamophyllous, very short, covering only the stalk of the ovary, ripe female, male and gall flowers unknown

New Guinea. H. O. Forbes, No. 625. A species which, in the form and arrangement of its receptacles, resembles *F. condensæ*, King, and in its leaves approaches *stipata*, King, *fasciculata*, King, and *Forbesii*, King.

Named in honour of Mr. L. Bernays, of Brisbane, whose efforts for the exploitation of New Guinea, and for the development of his own Colony of Queensland are so well-known.

EVERYWHERE.—Flowers unisexual, male and gall flowers in one set of receptacles, fertile female flowers in a distinct set of receptacles; male flowers with 2 stamens, receptacles small, axillary; scandent or erect shrubs or small trees, rarely epiphytal; the leaves alternate, softly hairy or glabrous, not scabrid or hispid.

*Ficus Pantomiana*, King; a glabrous climber; leaves alternate, shortly petiolate, coriaceous, almost exactly oval or ovate-oblong, entire, the apex slightly acute, the base rounded or sub-cordate 3-nerved; primary lateral nerves 4 pairs, rather prominent on the lower surface, which has wide obscurely tessellate reticulations; length of blade 3 or 4 inches, width 1.5 in. to 2 in.; petiole rather under .5 in.; stipules ovate-acute, glabrous, .3 in. long, receptacles in pairs from the axils of the leaves, but mostly from the scars of fallen leaves, smooth, globular, .4 in. in diam. produced at the base into a pseudo-stalk nearly .5 in. long, at the junction of which with the peduncle proper are 3 minute bracts; female flowers pedicillate, the perianth deeply 4-cleft, the lobes shorter than the ovate-oblong, smooth, pale-edged, ovary: style thick, lateral; stigma widely infundibuliform: male and gall flowers not seen.

New Guinea, H. O. Forbes, No. 185. I have not seen the recep-

acoles of this which contain the male and gall flowers; but I put it into this section with some confidence from its resemblance, in externals as well as in the structure of the female flowers, to *F. disticha*, Bl.

I have named it in honour of Mr. J. A. Panton, a distinguished Australian explorer.

*Ficus Baeuerleni*, King: scandent, the young shoots puberulous; leaves coriaceous, shortly petiolate, ovate-oblong or elliptic-lanceolate, the base rounded or subcordate 5-nerved (2 of the nerves minute), the apex gradually narrowed to a short point, the edges entire; primary lateral nerves 4 or 5 pairs, very bold (as is the midrib) on the under surface which is uniformly covered with very short soft brown tomentum; upper surface minutely tuberculate, length of blade about 7 inches, petiole 4 in.; stipules convolute, pilose externally, rather longer than the petioles; receptacles axillary, pedunculate, solitary or in pairs, depressed-globose, nearly 1 inch in diam., contracted at the base into a short pseudo-stalk, at the junction of which with the peduncle proper are 3 broadly triangular basal bracts; peduncle proper .25 in. long, tomentose; female flowers with a perianth of 4 distinct fleshy pieces which are shorter than the narrowly ovoid, smooth, ovary; style slender terminal; stigma halbert-shaped; male and gall flowers not seen.

New Guinea; H. O. Forbes, No. 378.

This has a general resemblance to *F. recurva*, Bl., in the form and venation of its leaves and in the position of the female flowers. It is, however, well distinct by the larger size of all its parts, but especially of its receptacles which are ten times as large as those of *recurva*, besides being pedunculate and of a different shape. This also resembles *lasiocarpa*, Miq.

I have named this after M. Baeuerlen, of the expedition sent by the Geographic Society of Australasia for the exploration of New Guinea.

*Ficus duriuscula*, King, Monog. Indo-Malayan and Chinese *Ficus*; a tree, all parts glabrous but rather harsh and sub-scabrid; leaves petiolate, membranous, elliptic narrowed to each end, or elliptic-lanceolate, the apex rather shortly acuminate, the edges undulate sub-crenate, base boldly 3-nerved biglandular; primary lateral nerves 4 to 6 pairs, thin but strong, as are the midrib and secondary nerves; reticulations minute, very distinct on the lower surface; both surfaces glabrous, the lower harsh to the touch; length of blade 5 to 10 inches; petioles swollen at either extremity, varying in length from .5 in. to 1 inch; stipules lanceolate, glabrous, .25 in. long; receptacles axillary or in fascicles of from 3 to 6, from small broad flat ebracteate tubercles from the stem and larger branches, pedunculate, globose, their sides slightly ridged towards the sub-umbonate apex, glabrous, muriculate-scabrid, .5 in. across,

base slightly constricted, ebracteate; peduncle thin,  $\frac{1}{4}$  in. to  $\frac{1}{8}$  in. long, with a few small scattered bracteoles, scabrid; male flowers with 2 stamens and a 5 or 6-cleft hairy perianth; gall flowers with a perianth similar in shape but not hairy, the ovary ovoid, the style short, lateral; fertile female flowers with the achene ovoid, smooth, mucilaginous externally when ripe; the style lateral, longer than the ovary, curved; the stigma clavate; the perianth as in the gall flower.

New Guinea, (Soron) Sig. Beccari (Herb. Becc. P. B., No. 188); H. O. Forbes, No. 765.

A species allied to the Australian *F. magnifolia*, Mull. and to *Madurensis*, Miq. but with shorter petioles and more muricate receptacles. It also comes near *breriuspus*, Miq., but its leaves are not obovate and their bases are not cordate as in that species; they are moreover longer, more pointed, and have shorter petioles. This also resembles *F. balia*, Miq. and *F. copiosa*, Steud. This, however, has two stamens, while the majority of those just mentioned have but one. The receptacles in Forbes's specimens are axillary and are more boldly muricate than in Beccari's No. 188: the leaves are also rather longer. When better material shall be forthcoming, it may be possible to separate these two forms specifically. At present I include them under one species.

*Ficus Odoardi*, King: Monogr. Indo-Mal. and Chinese *Ficus*; a tree, the young shoots covered with brown tomentum, the leaves oblong-elliptic, slightly inequilateral, gradually narrowed upwards to the shortly acuminate apex, the edges entire; the base broad, rounded, very slightly emarginate, 3-nerved; primary lateral nerves 5 pairs, prominent on the lower surface which is pretty uniformly hispid-pilose; upper surface slightly harsh and with some scattered stiff hairs especially on the nerves, the midrib minutely tomentose; length of blade from 6 to 9 inches; petiole about  $\frac{1}{3}$  in., tomentose; stipules ovate-acuminate, tomentose on the outer, glabrous on the inner, surface,  $\frac{1}{6}$  in. long; receptacles pedunculate, in pairs or solitary, axillary,  $\frac{1}{4}$  inch and upwards in diam., sub-globose, with conical umbonate apex and broad concave base, the sides rough, minutely tuberculate and decidedly hispid-pubescent or tomentose; the umbilicus minute, closed by stiff yellow hairs, and surrounded at some distance by a wavy annulus; basal bracts none; diameter,  $\frac{1}{25}$  in.; peduncles stout, clothed, like the receptacles, with deciduous tomentum,  $\frac{1}{3}$  in. long; male flowers pedicellate, large, occupying the upper half of the receptacles with the gall flowers; stamens 2, anthers linear, apiculate; perianth of 4 pieces, of which 2 are as long as and 2 are shorter than the stamens; gall flowers smaller, and on shorter pedicels, than the males, the perianth of 4 distinct pieces, the achene globular; style terminal, stigma slightly dilated; fertile female flowers not known.

New Guinea; Beccari, (P. P. No. 937); H. O. Forbes, No. 830. Named after Signor Odoardo Beccari, of Florence, the distinguished Malayan Explorer and Botanist.

*Ficus rhizophoraephylla*, King: scandent, all parts glabrous, the leaves thinly coriaceous, on long petioles, narrowly elliptic, tapering equally to either end, the edges entire cartilaginous and slightly recurved when dry, the midrib keeled and very prominent on the under surface; primary lateral nerves 12 pairs or upwards, sub-horizontal, scarcely visible on either surface; under surface minutely tessellate, dull; upper surface very smooth, shining; length of blade 3·5 in, breadth 1·5 in.; petiole 1·3 to 1·8 in. long: stipules linear-lanceolate, glabrous, as long as, or longer than, the petioles; receptacles crowded near the apices of the branches, in pairs, shortly pedicillate, globular, very minutely tuberculate, .25 in. in diam.; female flowers on strong cartilaginous prismatic peduncles thicker than the prismatico-conical smooth ovaries; style from the base of the ovary which it slightly exceeds in length, straight, erect; perianth of 3 linear pieces which rise from the margin of the peduncle: male and gall flowers unknown.

New Guinea: H. O. Forbes, No. 578.

Without having seen its male and gall flowers, I put this species without hesitation into the section *Eusyce*, on account of its resemblance to *F. oleaefolia*, King, a species from Sumatra which has leaves very like this in texture and venation, but is smaller in all its parts and especially in its stipules. A farther indication of affinity is found in the fact that the gall flowers of *oleaefolia* and the fertile females of this species have similar prismatic ovaries. This in foliage also resembles the Australian *F. eugenioides*, Mull., which however, has very different female flowers, and which moreover is monocious and falls into the section *Urostigma*. The leaves of this are of a pale greenish yellow when dry; in shape and venation they much resemble those of *Rhizophora conjugata*, Linn.

*Ficus pauper*, King, Monogr. Indo-Mal. and Chinese *Ficus*; leaves membranous, petiolate, slightly inequilateral, lanceolate or ovate-lanceolate, the apex acute, the edges entire, narrowed from below the midrib to the obscurely 3-nerved base; lateral primary nerves about 6 to 8 pairs diverging from the midrib at rather a wide angle and, like the midrib, prominent beneath; midrib with a few scattered adpressed hairs; upper surface glabrous; length of blade 1·5 in. to 2 inches; petiole .3 in. long, adpressed-strigose beneath; stipules persistent, scarious, deciduously sericeous, ovate-acuminate, .35 in. long; receptacles pedunculate, in pairs, axillary when young, globose, slightly constricted at the base, sparsely strigose, the umbilicus large and prominent; basal bracts 3,

broadly ovate, blunt, puberulous; peduncle .1 in long, densely puberulous, ripe receptacles unknown, male flowers with 2 nearly sessile anthers and a perianth of three distinct pieces, gall flowers with sub-globular smooth ovary, short thick lateral style and truncate stigma; female flowers unknown

New Guinea; Fly River, No. 49, D'Albertis This is apparently a shrub or small tree It approaches *F. erecta*, Thunbg., but is distinguished from that species by its smaller leaves which have more numerous and more horizontal primary lateral nerves than those of *erecta*, and by its adpressed strigose much smaller receptacles

*Ficus soronensis*, King, Monogr Ind. Mal and Chinese *Ficus*; young parts puberulous, leaves narrowly elliptic, tapering to either end, the apex shortly acuminate, the base acute, 3-nerved, the edges entire; primary lateral nerves 3 or 4 pairs, not very prominent, under surface sub-scabrid from numerous minute black tubercles, the reticulations open and rather distinct, length of blade 2 to 4 inches, petioles 3 in. long, stipules lanceolate, scarios, puberulous, 4 in long, persistent; receptacles in pairs from the axils of the leaves or of scars of fallen leaves, pedunculate, globular, sub-scabrid, minutely tuberculate, the umbilicus prominent basal bracts none, but a few verruciform bracts on the sides of the receptacle peduncles with one or two bracteoles, 15 in. long, female florets sessile or pedicillate, perianth of 3 or 4 pieces; achene sub-triangular, slightly hairy near the apex, style lateral, stigma cylindric truncate, male and gall flowers not seen

New Guinea, Soron, Beccari's Herb, P. P. No 458 This comes near some of the forms of *F. erecta*, Thunbg., but differs in having the under surface of the leaves more tuberculate and much smaller receptacles. It is not, however, far removed from *erecta*

**XXI.—Description of a new Species of Phytophagous Coleoptera alleged to be destructive to the Dhan Crops in the Chittagong District —By**  
**JOSEPH S. BALY. Communicated by the NATURAL HISTORY SECRETARY.**

[Received Feb 24th ;—Read March 2nd, 1887]

**HISPA AENESCENS**

*Subelongata, nitida, subtus cum antennis nigra, pedibus nigro-aeneo micantibus, supra nigro-aeneo aut nigro-cuprea, thorace rugoso-punctato, lateribus ante medium spinis quatuor, basi connatis, et post medium spinis unius armatis, elytris anguste oblongis, fortiter seriato-punctatis, spinis validis triseriatim dispositis, instructis Long 2 lin.*

**HAB Chittagong District**

Antennae slender, very slightly thickened towards the apex, the basal joint armed at its apex beneath with a short tooth, vertex finely rugulose, longitudinally sulcate. Thorax rather broader than long, subcylindrical, flattened on the disk, sides armed before the middle with four stout spines, united into a single stem at their base, the anterior spine looking almost directly upwards, the three others obliquely upwards and outwards, behind the middle is also a single spine looking outwards and slightly upwards, hinder angle armed with a short subacute tooth, disk coarsely rugose-punctate, a longitudinal vitta and a slightly concave space on either side behind the middle nearly free from punctures. Scutellum smooth, impunctate. Elytra narrowly oblong, strongly seriato-punctate, armed with a number of strong erect spines, arranged in three longitudinal rows, those on the outer row more crowded than those on the disk. Legs simple.

The small tooth at the lower edge of the apex of the basal joints of the antennae, and the absence of any spines on the upper surface of the joints, together with the colour of the upper surface of the body, will separate the above species from any others known to me

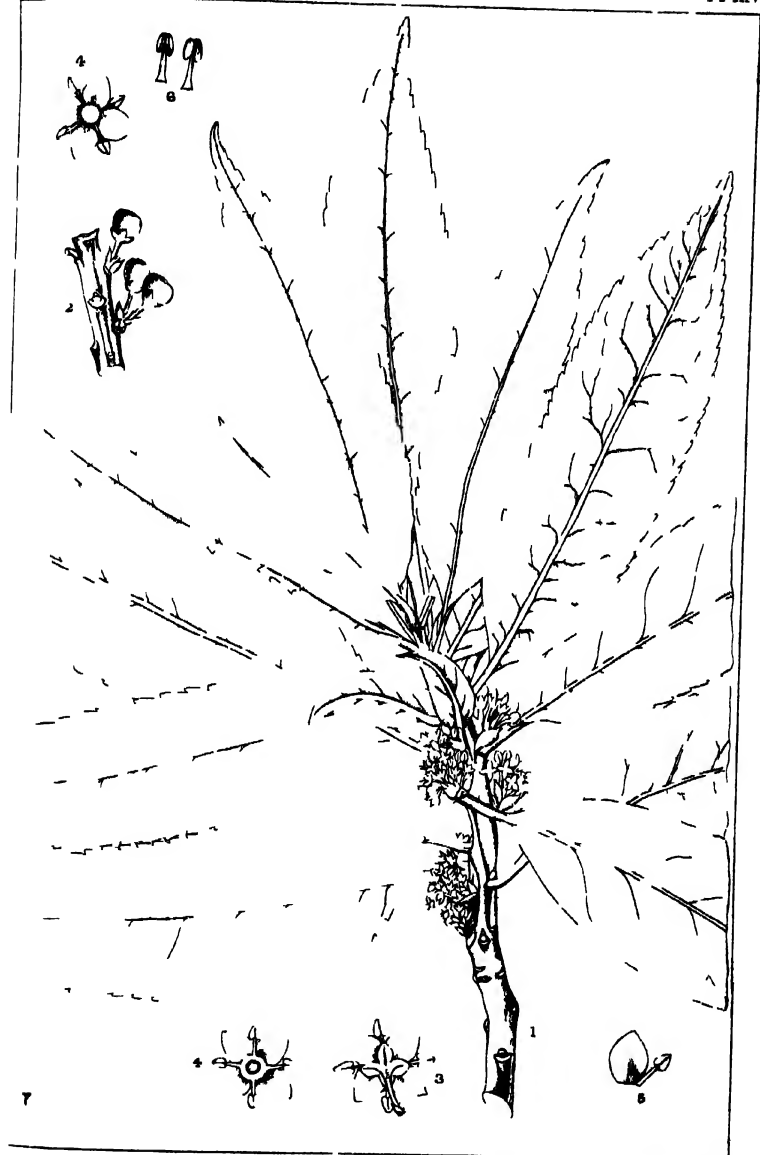












ILEX HOOKERI King

Porter & Conrad, in  
Ward, Robinson & Co. 1900





# CONTENTS

## OF THE NATURAL HISTORY PART (PT. II.) OF THE JOURNAL OF THE ASIATIC SOCIETY OF BENGAL FOR 1885.

---

No. 1, (issued July 6th, 1885). *Fourth List of Butterflies taken in Sikkim in October, 1884, with Notes on Habits, &c.*—By LIONEL DE NICÉVILLE. *Notes on Indian Rhynchota, No. 2.*—By E. T. ATKINSON, B. A. *On Observations of the Solar Thermometer at Lucknow.*—By S. A. HILL, B. Sc., A. R. S. M., Meteorological Reporter, North Western Provinces and Oudh. *List of the Butterflies of Calcutta and its Neighbourhood, with Notes on Habits, Food Plants, &c.*—By LIONEL DE NICÉVILLE. *Natural History Notes from H. M.'s Indian Marine Survey Steamer 'Investigator,' Commander ALFRED CARPENTER, R. N. Commanding No. 1. On the Structure and Habits of Cyrtophium calanicolus, a new Tubicolous Amphipod from the Bay of Bengal.*—By G. M. GILES, M. B., F. R. C. S., Surgeon-Naturalist to the Marine Survey (With Plate I.). *Notes on Japanese Land and Fresh-water Molluscs.*—By O. F. VON MÖLLENDORF, Ph. D. Communicated by the NATURAL HISTORY SECRETARY.

No. 2, (issued September 12th, 1885). *Natural History Notes from H. M.'s Indian Marine Survey Steamer 'Investigator,' Commander ALFRED CARPENTER, R. N., Commanding. No. 2. Description of a new Species of the Amphipod Genus Melita from the Bay of Bengal.*—By G. M. GILES, M. B., F. R. C. S., Surgeon-Naturalist, Indian Marine Survey. (With Plate III.). *Natural History Notes from H. M.'s Indian Marine Survey Steamer 'Investigator,' Commander ALFRED CARPENTER, R. N., Commanding. No. 3. On the Prothallus of Padina pavonia.*—By G. M. GILES, M. B., F. R. C. S., Surgeon-Naturalist, Indian Marine Survey. (With Plates IV. and V.). *Notes on Indian Rhynchota, No. 3.*—By E. T. ATKINSON, B. A. *Descriptions of some new Indian Rhopalocera.*—By LIONEL DE NICÉVILLE. (With Plate II.) *"The Swatch of no Ground."*—By Commander ALFRED CARPENTER, R. N., in charge of Marine Survey of India. Communicated by the NATURAL HISTORY SECRETARY.

No. 3, (issued December 29th, 1885). *Notes on Indian Rhynchota, No. 4.*—By E. T. ATKINSON, B. A. *Memorandum on the Corrosion of the Lead Linings of Indian Tea Chests.*—By ALEX. PEDLER, F. C. S., Professor of Chemistry in the Presidency College, Calcutta. *Indian Ants of the Indian Museum, Calcutta.*—By PROFESSOR AUGUST FOEBEL, Zurich. Communicated by the NATURAL HISTORY SECRETARY.

---

NEW SERIES.

VOL. LVIII.

CCLXXXIX.

# JOURNAL

OF THE

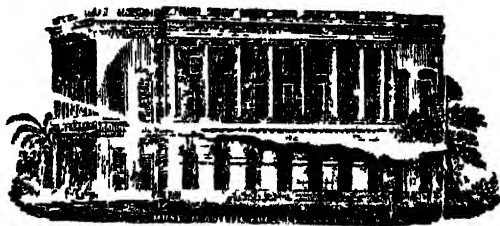
## ASIATIC SOCIETY OF BENGAL.

Vol. LVIII, Part II, No. I.—1889.

EDITED BY

J. WOOD-MASON, Esq.

VICÉ-PRÉSIDENT



"The bounds of its investigation will be the geographical limits of Asia and within these limits its inquiries will be extended to whatever is performed by man or produced by nature." —SIR WILLIAM JONES

\* \* \* Communications should be sent under cover to the Secretaries, Asiat. Soc., to whom all orders for the work are to be addressed in India, or, in London, care of Messrs. Trubner and Co., 57 & 59, Ludgate Hill.

CALCUTTA.

PRINTED BY P. H. ROUSE, AT THE BAPTIST MISSION PRESS,

AND PUBLISHED BY THE

ASIATIC SOCIETY, 57, MARK STREET.

1889.

Price (exclusive of postage) to Subscribers, Rs. 1.—To Non-Subscribers, Rs. 1-6  
Price in England, 3 Shillings and sixpence.

Issued May 21st, 1889.

## CONTENTS.

---

|                                                                                                                                                                                                                                                                                    | Page |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| I.— <i>A new Species and Genus of Coccidæ</i> .—By E. T. ATKINSON, B. A.<br>(With Plate I.).....                                                                                                                                                                                   | 1    |
| II.— <i>On the Species of Thelyphonus inhabiting Continental India, Burma, and the Malay Peninsula</i> .—By EUGENE W. OATTS, F. Z. S. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM. (With Plate II.) .....                                                              | 4    |
| III.— <i>Notes on Indian Rhynchota; Heteroptera, No. 5</i> .—P. A. ATKINSON, B. A.....                                                                                                                                                                                             | 20   |
| IV.— <i>On certain Earthworms from the Western Himalayas and Dehra Dun</i> .—By J. C. BOUENÉ, D. SC. (LOND.), C. M. Z. S., F. L. S., Fellow of University College, London, and Madras University. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM. (With Plate III.) ..... | 110  |
| V.— <i>Notes on Assam Butterflies</i> .—By WILLIAM DOHERTY, Cincinnati, U. S. A. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM. (With Plate X.).....                                                                                                                     | 118  |

---

Plate X, illustrative of Mr. Doherty's article on Assam Butterflies, will be issued with the next number.



# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL.



### Part II.—NATURAL SCIENCE.

~~~~~  
No. I.—1889.
~~~~~

I.—*A new Species and Genus of Coccidæ*.—By F. T. ATKINSON, B. A.

[Received September 30th;—Read November 7th, 1888.]

(With Plate I.)

The Coccid described below was received from Mr. F. Gammie, who procured it at Munghphu (3800 feet) in Sikkim on *Quercus incana*, *Castanea indica*, and *O. tribuloides*. I forwarded specimens to Mr. W. H. Maskell of Wellington, New Zealand, who devotes much attention to this family, and he has kindly sent me the drawings of the insect in its different stages shown on the accompanying plate. This coccid clearly belongs to Maskell's group *Hemicoccina*, which is characterised by having, in the larval stage, the anal tubercles of the *Coccina*, and, in the adult female, the abdominal cleft and lobes of the *Lecanina*. I had provisionally placed this insect in the genus *Pulvinaria* of the group *Lecanina*, as the adult female does not appear to differ from the adult females of that genus. Mr. Maskell was at first of the same opinion, but, having examined the larval form in its earliest stages, he found that it presented undoubted and distinct 'anal tubercles' (Fig. 11), which at once remove it from the *Lecanina*.

It cannot be placed in the genus *Kermes* of the group *Hemicoccina* owing to structural differences, so that we have to form a new genus, to which the name *Pseudopulvinaria*, as suggested by Mr. Maskell, has

been given to show its connection with the lecanid genus *Pulvinaria*. The insect is really a hemiccoccid possessing more lecanid appearances than any other of the group hitherto known. The position of the insect on the tree during its several stages is rather curious. The larvæ and the females of the second stage cluster along the midrib of the lower surface of the leaf, whilst the adult female alone is found along the twig to which the leaves are attached (Fig. 1). The secretion is closer than in *Pulvinaria*, and quite as cottony during the larval stage, but, in the second stage, becomes more waxy, so as to approach in appearance the genus *Orthezia*, and the masses of wax on the leaves are more like detached or attached plates (Fig. 2) than threads. Unfortunately the male has not yet been secured.

It is satisfactory to know that the adult female is subject to the attacks of several species of hymenopterous and dipterous parasites, which we may hope to characterise hereafter, for, otherwise, from the size and number of these coccids on the leaves and twigs affected, much damage must ensue, should they increase to any extent. It disappears during the rains (July—September), but comes on abundantly at the close of the rains, and matures about April.

#### Genus PSEUDOPULVINARIA nov.

Adult females naked, without a waxy fringe, somewhat circular or oval and flattish. In *Kermes*, the adult female is entirely globular, except a small incision where it rests on the twig to which it is attached, and appears to have neither legs, antennæ, nor rostrum.

#### PSEUDOPULVINARIA SIKKIMENSIS, n. sp.

Adult ♀, above reddish-brown, naked, somewhat convex, irregularly circular or oval in shape, varying in size, skin smooth, punctulate. The insect frequently falls off, leaving the white cottony ovisac attached to the twig. Furnished beneath with eyes, antennæ, legs and rostrum; the abdominal cleft and lobes distinct (Fig. 5): antennæ borne on a tubercle, 6-jointed, second joint longest, unarmed; others with setæ varying in length (Fig. 6): claw with four digitules, the upper pair longest (Fig. 7). The ovisac on which the female rests is formed of a compact white cerous substance, following and extending beyond the outline of the insect itself. The spinnerets (*filières*: Fig. 8) are scattered irregularly over the nether caudal surface and are not arranged in groups or circles. Found only on the twigs: long, 5—9 mill.

The ♀ of the second stage (Fig. 9) with its waxy plates is found on the lower surface of the midrib of the leaf. These plates seem to be

attached transversely to a longitudinal median ridge and give this form a peculiar ribbed appearance.

The larval form is furnished with antennæ, legs, rostrum, and anal tubercles bearing long setæ (Fig. 10). These tubercles are very distinct in the earliest stage of the larva (*l'état embryonnaire*: Fig. 11), and are characteristic of the group.

The ♂ is unknown.

Hab. Mungphu (3800 feet), Sikkim.

#### EXPLANATION OF PLATE 1.

- Fig. 1. Insect on twig and leaves. slightly reduced.  
2. Waxy masses on leaves, magnified.  
3. Adult ♀, dorsal aspect, cotton removed: magnified about 4.  
4. Same, ventral aspect, cotton removed: magnified.  
5. Same, abdominal cleft, lobes, anogenital ring and spinnerets: do.  
6. Same, antennæ: × 90.  
7. Same, claw and digitules: × 90.  
8. Same, spinnerets: magnified.  
9. ♀ of second stage, dorsal aspect, with waxy plates.  
10. Larva, ventral aspect × 90.  
11. Anal tubercles just before emerging from the egg: magnified.  
12. Edge of the body of larva with hairs &c.: × 350.
-

II.—On the Species of *Thelyphonus* inhabiting Continental India, Burma, and the Malay Peninsula.—By EUGENE W. OATES, F. Z. S. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM.

[Received January 24th ;—Read April 3rd, 1889.]

(With Plate II.)

The obscure animals which belong to this genus are very little known. I have steadily collected them for some years now with the best results, and not long since I took the opportunity of studying the specimens contained in the Indian Museum, all of which were very kindly placed at my disposal by Mr. J. Wood-Mason, the Superintendent of the museum.

There are now thirteen species known within the above limits, of which three have been already described, eight are new to science, and two are unknown to me, and in my opinion insufficiently described to be ever determinable. These two were described by Mr. A. G. Butler many years ago and in terms which, when applied to these animals, are altogether insufficient. For this reason I have excluded them from this paper, and I hope to notice them on a future occasion, when I have had time to examine the types, which I understand are in the British Museum. These two species are *T. sepiaris*, described from Tonghoo and Ceylon, and *T. nigrescens*, from Tenasserim (Cist. Ent. vi, p. 129).

The *Thelyphoni* live under timber and stones, lying concealed during the day time and creeping about at night only. When discovered, they seem overcome with surprise, but they speedily recover and hurry away with considerable speed into holes and crevices. They are frequently found at the roots of trees under accumulations of dead leaves and rubbish. They require moisture, but must have well drained soil.

I have never found two species together, and my experience is that each species inhabits a tract of country to the exclusion of others. For instance, in Rangoon *T. rangunensis* is found; proceeding 80 miles north, this species ceases and *T. sylvaticus* occurs. Similarly, further north *T. saxatilis* is alone found to occur. Reef and Double Islands each has its peculiar species. The species which so far as I know has the largest area of distribution is *T. indicus*, but the localities "Western Bengal and Southern India" attached to the few specimens I have been able to examine are so vague that no certainty can be attached to this point.

The *Thelyphoni*, when once you get into the way of finding them, are sufficiently abundant. I have frequently found twenty in one morning,

and, on one occasion, while visiting the lighthouse on Double Island, I secured 360 in three hours' work, myself and one man.

All the species I have met with emit a peculiar odour, more like aromatic vinegar than anything else I know, but more pungent. This odour emanates from a liquid which is ejected from an orifice near the root of the tail, and so powerful is it that it has frequently betrayed to me the position of the animal. On one occasion, when examining a live animal, I had a drop of the liquid injected into my eye, but it proved to be harmless.

These animals, it is hardly necessary to state, are quite incapable of inflicting injury to anything large than an insect. They have no sting and their cheliceres are very weak. A writer in the "Scientific American" sometime ago graphically described how a species common in Florida was in the habit of killing horses, so powerful was its sting. This is of course all nonsense.

I have not been able to discover anything regarding the breeding of these whip-scorpions. I have taken the very young only a-quarter of an inch in length and also what appeared to be pregnant females, but I could find neither eggs nor embryos in them. Mr. Fee, the energetic Italian naturalist now working in Burma, informs me, however, that he once discovered a female carrying a bunch of egg under her cephalothorax by the aid of her first pair of legs. This is all I know about the matter.

The two sexes of the *Thelyphoni* grow up absolutely alike till full grown. At this stage, the male, by some process upon which I am able, I am sorry to say, to throw no light, undergoes a transformation and emerges from it totally ~~unlike~~ <sup>different</sup> from the female. That this is fact can admit of no doubt. Adult males are nearly as abundant as adult females, but half or three-quarter grown males with the external characters of the adult male, or with any characters at all not possessed by the female, are unknown. Once adult the sexes are as different as possible in appearance.

The immature animals resemble the adult female in all characters except colour, and in this latter respect the differences are not great, reds being replaced by olive-yellows or greens and black tints by pink ones.

In growing up, they seem to undergo numerous moults just like the scorpions and spiders.

The adult sexes are markedly different in all the species I know. The more marked difference is in the size and armature of the cheliceres, but there are minor differences, such as the grooving or entirety of the first lower abdominal segment, the size of the abdomen, and the colour of the cheliceres.

Adults of both sexes may be recognized by a certain redness and tumidity of the first lower abdominal segments not apparent in the immature animal.

I append a key to the eleven species known to me, and, in the plate, I have figured some parts of certain animals which will be of great assistance in the discrimination of the species.

In my descriptions I have only dwelt upon those characters which are of importance, chiefly the details of the cheliceres, the colours, and the important points of the cephalothorax and abdomen. I have not found the legs to vary in any appreciable degree in the different species, and therefore I have omitted them.

It will be noticed in the key that the females of some species cannot be discriminated from each other. I do not mean by this that the females are absolutely alike, but merely to express my inability to diagnose them in intelligible brief terms. Compared with each other they are sufficiently distinct, varying in shade of colour, shape of cheliceres, and in other points.

There are many immature specimens in the Indian Museum which I have hesitated to describe till mature animals are available. It is to be feared that many of the descriptions of these animals are based on young specimens, and, if so, they are useless, as the young of many species (which, when adult, are perfectly distinct) are absolutely alike.

On examining the specimens which the late Dr. Stoliczka referred to *T. angustus*, Lucas (J. A. S. B. 1873, pt. ii, p. 134), I found that the specimens were referable to the young of *T. assamensis*, *T. formosus*, and a species from Penang, the adult of which is unknown.

#### *Key to the Species.*

- a. With a sharp ridge between the central and lateral eyes.
  - a'. First joint of cheliceres with a lateral spine as well as a terminal one.
    - a''. Apophysis of the fourth joint of the cheliceres cylindrical, smooth on both edges, the outer edge rounded off at the tip (Fig. 13), ..... *assamensis*, ♂.
    - b''. Apophysis of the fourth joint of the cheliceres sharply triangular, serrated on both edges, ..... *assamensis*, ♀.
  - b'. First joint of cheliceres with only a terminal spine; second joint generally with 6 teeth.

- c'. First lower abdominal segment divided longitudinally by a groove (Fig. 3 and 4).  
 a'''. Groove very deep and distinct (Fig. 3).  
 a\*. Moveable finger of cheliceres festooned interiorly (Fig. 5); the terminal joint of the cheliceres of large size, broader than the fourth joint, ..... *indicus*, ♂.  
 b\*. Moveable finger of cheliceres simply rounded interiorly (Fig. 11); the terminal joint of the cheliceres weak, much narrower than the fourth, ..... *johorensis*, ♂.  
 b'''. Groove very shallow and indistinct (Fig. 1), *indicus*, ♀.  
 d''. First lower abdominal segment entire, with no trace of a groove, ..... *johorensis*, ♀.  
 b. With no sharp ridge between the ventral and lateral eyes, this region being rounded.  
 c'. Apophysis of fourth joint of cheliceres long and cylindrical, smooth on both edges, suddenly and quadrately widened out on the terminal quarter of its length (Fig. 12), ..... *andersoni*, ♂.  
 d'. Apophysis of fourth joint of cheliceres cylindrical, smooth on both edges, suddenly narrowed on the terminal half of its length (Fig. 10), ..... *wood-masoni*, ♂.  
 e'. Apophysis of fourth joint of cheliceres absolutely cylindrical, the two edges being parallel throughout their length and smooth (Fig. 7).  
 e''. Length of abdomen and cephalothorax 1·3 inch, ..... *insularis*, ♂.  
 f''. Length of abdomen and cephalothorax 1 inch, ..... *formosus*, ♂.  
 f'. Apophysis of fourth joint of cheliceres approximately cylindrical but the edges more or less swollen towards their extremities (Fig. 9).  
 g''. Inner edge of the fourth joint of the cheliceres coarsely granulated; the inner edge of the third joint double the length of the front edge of the second, ..... *binghami*, ♂.  
 h''. Inner edge of the fourth joint of the cheliceres smooth; inner edge of third joint equal to the front edge of the second.  
 c'''. The three hinder pairs of legs uniformly red, ..... *saxatilis*, ♂.





large apophysis on the interior-front corner, long and cylindrical, terminated with a large spine and furnished below with numerous teeth like a coarse file (Fig. 13); fifth joint much narrower than the fourth, fixed finger short and triangular almost smooth on both edges, movable finger long and curved, serrated below, in shape much as in Fig. 11; one sharp spine on the lower projecting angle of the joint; first joint of cheliceres below densely punctured and slightly wrinkled in places; the anterior process with a lateral spine as well as a terminal one; cephalothorax densely granulated all over with a very pronounced sharp ridge between the lateral and middle eyes.

First lower abdominal segment wrinkled in the middle, not divided by a groove; posterior edge well rounded.

*Structure* ♀. Cheliceres as densely granulated as in the male; second joint with five very distinct teeth in front and two spines below; third joint with a blunt spine on the interior edge and a long, sharp one below; fourth joint with a minute spine below and a triangular, pointed apophysis on the interior-front corner serrated on both edges (Fig. 8); fifth joint very narrow and feeble, fixed finger short and sharply triangular, serrated on both edges, movable finger long and sharply pointed, curved (Fig. 6), serrated on the inner edge; first joint of cheliceres below as in the male.

Cephalothorax as in the male. First abdominal segment below differing in no respect from that of the male.

Found throughout Assam and Sikkim, and the hill-ranges of Eastern Bengal and Cachar.

The late Dr. Stoliczka appears to have been ignorant of the great difference of structure between the sexes of these animals, and he describes the two sexes under different names. His name has priority over Mr. Butler's by four years. This species is widely distributed and appears to be common, and was consequently, we may suspect, known to the earlier writers on these animals, but to identify it with any of their names is now impossible. It will be well, therefore, to adopt Dr. Stoliczka's name instead of making fruitless attempts to find an earlier one.

## 2. *THELYPHONUS INDICUS*. Pl. II, Figs. 1—6.

*Thelyphonus indicus*, Stoliczka, J. A. S. B. 1873, pt. ii, p. 138, pl. xii, fig. 5.

„ *beddomei*, „ J. A. S. B. 1873, pt. ii, p. 142, pl. xii, fig. 6.

♂. Cephalothorax and abdomen dull chestnut-brown; cheliceres bright chestnut; legs and tail deep red below, cheliceres deep chestnut; abdomen, sternum, and legs bright chestnut. Length 1·3 inches.

♀. Similar to the male in colour.

*Structure, ♂.* Cheliceres strong; basal joint slightly punctured and wrinkled towards the front; second joint densely and coarsely granulated, the anterior portion rounded, with five or more sharp distinct teeth on the edge and two stronger ones on the lower surface; third joint thickly punctured all over and wrinkled towards the interior edge, which is angular and furnished with one spine, another spine below; fourth joint sparingly punctured all over and slightly granulated towards the origin of the apophysis which is triangular (Fig. 1) and slightly curved backwards, closely serrated on the outer edge and furnished with a few blunt spines on the inner; fifth joint large, broader than the fourth, sparingly punctured all over, fixed finger triangular, short and broad, finely serrated on the outer edge, the inner edge rough and furnished with a few small spines; movable finger slightly curved, the upper edge sinuated, finely serrated and with a blunt tooth near the tip (Fig. 5.), the lower edge simply curved and roughly serrated.

Cephalothorax densely granulated with a sharp sinuated ridge between the lateral and central eyes.

First lower abdominal segment of huge size, tumid, divided longitudinally by a groove and broadly rounded posteriorly (Fig. 3).

*Structure, ♀.* The abdomen much larger and the cheliceres shorter and slighter; the apophysis of the fourth joint of the cheliceres is also much broader at the base, but of about the same length, and consequently much blunter; the first abdominal lower segment is pointed posteriorly and barely grooved (Fig. 4). The movable finger is also of a very different shape and size (Fig. 6).

An examination of the late Dr. Stoliczka's types and of some other specimens more recently acquired by the Indian Museum demonstrates that his *T. indicus* is the male and *T. beddomei* the female of the same species.

The number of teeth on the front edge of the second joint of the cheliceres varies much in this species as may be seen from the following enumeration of examples examined.

♂. 7 teeth on right; 5 on left with traces of 3 more.

♂. 6 on right one being bifid; 5 on left with trace of another.

♂. 6 on right; 5 on left.

♂. 6 on right; 5 on left.

♀. 7 teeth on each side (*T. beddomei*).

All the specimens I have examined came from Southern India and Western Bengal, but no precise locality is attached to them.

Mr. Butler identifies his *T. sepiaris* with this species (Ann. & Mag. Nat. Hist. ser. 4, vol. xii, p. 116), but as he gives *T. sepiaris* from Tonghoo and Ceylon, and allows *T. beddomei* to be a good distinct species,

I fear the matter is too involved for me to arrive at any conclusion on the subject without the examination of his type, and for this I have had no opportunities.

3. *THELYPHONUS JOHORENSIS*, n. sp., Pl. II, Fig. 11, ♂.

♂. Cheliceres very deep red; cephalothorax nearly black; abdomen deep red; legs deep madder, brighter towards the extremities; below, first joint of cheliceres deep red; abdomen, sternum and exinguinal joints of legs blood red. Length 1·2 inches; cheliceres ·5 inch.

♀. Similar in colour to the male; slightly smaller.

*Immature animal.* Cephalothorax and abdomen red, legs brighter, cheliceres bright coral-red.

*Structure*, ♂. First joint of cheliceres densely punctured all over; second densely punctured, with six teeth on the anterior and lateral edges and two strong spines below; third densely punctured all over, with a very strong spine below; fourth joint densely punctured, with a long recurved triangular apophysis, serrated on the outer edge, and with a few teeth on the outer; fifth joint (Fig. 11) weak, narrower than the fourth, sparingly punctured, fixed finger serrated on the outer edge, with a few spines on the outer and down the side of the joint; movable finger weak, serrated on the inner edge, with a few spines on the lower edge.

Cephalothorax densely granulated all over, the space between the central and lateral eyes ridged.

First lower abdominal segment deeply grooved longitudinally (Fig. 3), extremely swollen large and rounded.

*Structure*, ♀. Similar to the male, but the apophysis of the fourth joint of the cheliceres shorter and broader at base; first lower abdominal segment without a longitudinal groove, and pointed posteriorly.

I have much pleasure in naming this species after the territory of the Sultan of Johore, where Mr. Wood-Mason discovered it.

4. *THELYPHONUS ANDERSONI*, n. sp., Pl. II, Fig. 12.

♂. Cephalothorax and cheliceres dark red, the legs paler red, the abdomen of intermediate colour; below, cheliceres dark red; abdomen, sternum and exinguinal joints of legs pale red; tail rather paler than the legs. Length 1 inch.

♀. Similar in colour to the male and of same size.

*Immature animal.* Unknown.

*Structure*, ♂. Cheliceres smooth with a very few minute punctures; first joint normal; second with a few obsolete teeth on the anterior and lateral edge and two strong spines below; third with a

sharp tooth on the lower surface; fourth with an indistinct spine on the lower edge and with a long apophysis on the interior angle. This apophysis is about the same length as the joint to which it is attached, perfectly cylindrical for three-quarters of the length, and suddenly widened out on the terminal quarter of its length to a width half as wide again as the cylindrical portion and terminating in a single recurved spine (Fig. 12); fifth joint feeble, narrower than the fourth, the interior edge toothed and furnished with hairs, the exterior edge of the fixed finger serrated; movable finger curved, sharply pointed, furnished with hairs and serrated below. Cephalothorax densely granulated, except on a portion between the lateral and central eyes, which is smooth and tumid but not ridged. First lower abdominal segment large, broadly sinuated behind, but not grooved.

*Structure, ♀.* Differs from the male in the structure of the cheliceres and first lower abdominal segment. Second joint of cheliceres with five distinct teeth, one on the middle of the anterior edge and four on the lateral, the foremost, situated at the angle of the two edges, being twice as large as the others, which are all of equal size, two small spines on the lower surface; third joint with a small tooth on the interior edge and one below; fourth joint with a short and sharply triangular apophysis, both edges serrated; fifth joint as in the male.

The first lower abdominal segment is longer and pointed posteriorly.

I have much pleasure in naming this species after Dr. John Anderson, the late Superintendent of the Indian Museum, who discovered it in Upper Burma. The male was taken in the second defile of the Irawadi river and the female on Pudeepyoo mountain. Both are preserved in the Indian Museum.

The only female of this species is much mutilated, but I have described it to the best of my power. I regret, however, to have to leave it out of my key; when writing which I had not access to the specimen.

##### 5. *THELYPHONUS WOOD-MASONI*, n. sp., Pl. II, Fig. 10.

♂. Cheliceres and cephalothorax pitchy-black; abdomen black tinged with red; legs blood-red; tail like the legs; below, first joint of cheliceres dark reddish-brown; legs and sternum with first abdominal segment blood-red, remainder of abdomen darker red.

♀. Similar to the male in colour.

*Immature animal.* Cheliceres coffee-brown, cephalothorax and abdomen dull rufous, the legs dull reddish vandyke-brown.

Length, male 1 inch; female, .95.

*Structure, ♂.* Cheliceres very sparingly punctured and nearly smooth all over, the exterior angle of the second joint transversely

wrinkled; second joint with 3-6 obsolete teeth on the anterior and interior edges and two blunt spines below; third joint with one spine below, the interior edge equal in length to the anterior edge of the second joint; fourth joint very broad, no spine below, with a long apophysis springing from the antero-lateral corner, the first half cylindrical and broad, the terminal half about half the thickness of the first and constricted in the middle, quadrately terminated and furnished with a small spine at the end (Fig. 10), the inside of the apophysis at the end with a large rounded process; fifth joint large, rounded, broader than the fourth joint, the inner edge scooped out to receive the rounded process on the apophysis of the fourth joint, causing the fixed finger to stand out as a cylindrical tooth serrated on both edges; movable finger moderately curved, serrated on the inner edge.

Cephalothorax densely granulated, the space between the anterior and the lateral eyes tumid.

*Structure.* ♀. Cheliceres with the first joint normal; second with five teeth on the anterior and lateral edges and two spines below; third joint with a lateral spine and one below; fourth with a spine below and a sharply-pointed triangular apophysis serrated on the inner edge and with 3 spines on the outer; fifth joint weak, narrower than the fourth, the fixed finger sharply triangular and serrated on both edges, the movable finger gently curved and serrated on the inner edge.

The cheliceres, as in the male, are nearly smooth, being very slightly punctured in a few places only.

Described from specimens taken on Muleyit mountain in Tenasserim and now in the Indian Museum. I have named it after Mr. J. Wood-Mason, the energetic Superintendent of the Indian Museum.

6. *THELYPHONUS INSULARIS*, n. sp., Pl. II, Figs. 7, 8.

♂. Cheliceres, cephalothorax, and abdomen deep black; legs and tail bright red; below, the first joint of cheliceres deep red, the other joints black, abdomen and legs bright red. Length 1.3 ins.; cheliceres .75 ins.

♀. Of the same colour as the male. Length 1.3, chel. .5 in.

*Immature animal.* Fourth and fifth joints of the cheliceres pink, second and third pinkish-brown; cephalothorax and abdomen greenish; coxal and femoral joints of legs pale greenish-brown, the remaining joints and the tail pale orange-yellow; below, first joint of cheliceres pale red, the other joints, and the legs, of the same colour as the upper surface, abdomen pale greenish-brown. With age the colours become firmer and the changes to the adult stage are very gradual. In half-grown specimens the legs are nearly uniform red and the cheliceres becoming blackish.

*Structure, ♂.* Second joint of cheliceres punctured all over, granulated and wrinkled at the anterior lateral corner, teeth on the interior and anterior margins indistinct, very variable in number and in all cases small and obsolete, no distinct spine below. Third joint punctured all over and coarsely granulated on the inner edge, with a spine below. Fourth joint with very few punctures, nearly smooth, apophysis long and cylindrical, terminated with two blunt teeth and with a large rounded process interiorly near the end (Fig. 7). Fifth joint very large and round, very nearly smooth, fixed finger short, triangular with a broad base, serrated on both edges, movable finger rather shorter than the fifth joint, serrated and sinuated within (Fig. 5). First joint beneath very sparingly punctured.

Cephalothorax granulated all over and transversely wrinkled behind the central eyes.

First lower abdominal segment smooth in the middle, not divided longitudinally by a groove.

*Structure, ♀.* The upper surface of cheliceres sparingly punctured throughout, 2nd joint with five very distinct teeth on the front and lateral edges, of which the two on the front edge are the largest, two teeth on the lower surface; third joint with a tooth on the interior edge and one below; fourth joint with a tooth below, the apophysis triangular, finely serrated on the outer edge, with two or three teeth on the inner (Fig. 8). Fifth joint narrower than the fourth, fixed finger sharply triangular, serrated on the outer edge, also on the inner edge nearly down to the bottom of the joint; movable finger shorter than fifth joint, gently curved throughout and serrated interiorly.

Cephalothorax and other parts, as in the male, except the first lower abdominal segment, which is pointed posteriorly.

This species is remarkable for the huge cheliceres of the adult male. It is common on Double Island at the entrance of the Moulmain River, to which island it appears to be confined, for on the opposite coast of the mainland *P. formosus* only is found. This island, which is crowned by a lighthouse, is very rocky, and only a few acres in extent. Some soft soil is found here and there under the rocks and under the bricks used for the staircase up to the summit of the island, and under these this animal occurs in incredible numbers.

#### 7. *THELYPHONUS FORMOSUS.*

*Thelyphonus formosus*, Butler, Ann. and Mag. Nat. Hist. ser iv, vol. x, p. 201, pt. xiii, f. H.

" " Stoliczka, J. A. S. B. 1873, p. 137, pt. xii, f. 4.

♂. Cheliceres shiny-black; cephalothorax black slightly tinged

with red; abdomen reddish-brown tending to black; legs entirely dark red; lower surface dark chestnut, the first joint of the cheliceres much deeper; tail paler than the legs. Length 1 inch.

♀. Similar to the male in colour, and somewhat larger.

*Immature animal.* Cheliceres brownish-red turning to almost pure red at the end; cephalothorax black; abdomen olivaceous-brown: first three joints of all the legs olive-green; remainder of the legs and the whole lower surface pale reddish-yellow, darker on the first joint of the cheliceres.

*Structure, ♂.* Cheliceris very sparingly punctured all over, the second joint with a few wrinkles across the exterior portion, and with five more or less obsolete teeth on the anterior and interior edges; two spines on the lower surface; third joint with one spine below; fourth joint with a minute spine below and a long cylindrical apophysis on the interior-front angle, terminated below by a bifid tooth, and with a large rounded tubercle within; fifth joint large, broader than the fourth with a spine beneath, the fixed finger very short and triangular, serrated on both edges, movable finger sharp and curved (Fig. 11), finely serrated interiorly.

Cephalothorax finely granulated all over; space between lateral and frontal eyes swollen but not ridged.

First abdominal segment below smooth, not divided, broadly rounded posteriorly.

*Structure, ♀.* Second joint of cheliceres with five very distinct teeth on the front edge and two spines below; third joint with a spine below; third joint with a minute spine below and a short, bluntly-triangular apophysis on the interior-frontal angle, serrated interiorly and with a few teeth on the outside; fifth joint weak and narrow, the fixed finger triangular, sharply pointed and serrated on both edges, the movable finger weak, sharply curved and serrated within.

Cephalothorax as in the male.

First abdominal segment below smooth, the middle posterior portion abruptly lengthened.

Found in the neighbourhood of Moulmein in Tenasserim, where it appears to be common.

#### 8. *THELYPHONUS BINGHAMI*, n. sp.

♂. Cheliceres and cephalothorax deep black; abdomen black tinged with red; legs bright red; below, first joint of cheliceres and the abdomen deep red, legs bright red.

♀. Of the same colour as the male, but the cheliceres strongly tinged with red.

*Immature animal.* First and second joint of cheliceres reddish-brown, the others coral-red; cephalothorax and abdomen dark brown; first three joints of all the legs olive-green, the others pale yellowish-red; below, the cephalothorax and abdomen reddish-brown.

Length 1.1 inches; cheliceres, ♀ .55; ♀ .45 inch.

*Structure, ♂.* Cheliceres sparingly granulated and punctured all over. Second joint with five ill-defined teeth on the front and lateral edges and two small spines below; third joint very long and cylindrical with one spine below; fourth joint long, the inner side granulated; with a blunt spine below and a long cylindrical apophysis on the anterior-lateral corner, slightly constricted in the middle and enlarged at the tip (Fig. 9) terminated with a rather sharp spine and a tumid process interiorly; fifth joint as broad as the fourth, serrated and festooned on the inner edge; fingers remarkably small, the fixed one triangular, nearly smooth on the inner edge, serrated on the outer, the movable one gently curved and serrated interiorly.

Cephalothorax minutely and densely granulated, the space between the lateral and frontal eyes barely tumid.

First lower abdominal segment entire, elevated and projecting posteriorly.

*Structure, ♀.* Cheliceres as in the male, but the second joint with five sharp and well-defined teeth, one on the anterior edge and four on the inner lateral edge; apophysis of fourth joint triangular with a few large spines on the inner edge and closely serrated on the outer; the fifth joint is much narrower than the fourth but the two fingers are the same as in the male. The third joint is much shorter and broader than the same one in the male and the whole cheliceres are shorter and stouter.

Cephalothorax exactly as in the male.

First abdominal segment entire, and rounded posteriorly as in the male.

The males and females of this species approach each other very closely in structure with regard to the cephalothorax and abdomen and the only point of distinction lies in the cheliceres.

This species is very abundant on Reef Island at the entrance of the Tavoy river in Tenasserim. It is a densely wooded island crowned by a small lighthouse. It is probably this species which Mons. Simon records from Tavoy and not *T. formosus*.

I have much pleasure in naming this species after Major C. T. Bingham, of the Forest Department of India, who has greatly assisted me in collecting these obscure animals.



9. *THELYPHONUS SAXATILIS*, n. sp.

♂. Cephalothorax, cheliceres, and abdomen black; first pair of legs reddish-black, except the tarsal joint, which, with the three other pairs of legs, is bright red; tail reddish-brown; below, the first joint of cheliceres black tinged with red; sternum and base of legs red; legs the same colour as the superior surface; abdomen reddish brown.

♀. Resembles the male in colour.

*Immature animal.* Cheliceres reddish-brown turning to pink on the last two joints; cephalothorax and abdomen dark olive-brown; first pair of legs olive, except the tarsal joint, which, with the three other pairs of legs, is pale red; below, uniform pale red, except the base of the cheliceres, which is reddish-brown.

Length 1.1 inch; cheliceres of male, .5.

*Structure, ♂.* Second joint of cheliceres punctured all over, the exterior-front corner wrinkled, the anterior and lateral edges with a few obsolete teeth, varying in number, one spine below; third joint punctured on the upper surface, granulated on the inner, and one blunt spine below; fourth joint nearly smooth, merely with a very few punctures, no spine below, apophysis long and cylindrical, constricted in the middle, rather swollen at the end with a tumid process on the inner side near the tip (Fig. 9); fifth joint large, nearly entirely smooth, fixed finger short and triangular, serrated on the outer edge, nearly smooth on the inner; movable finger rather long, curved throughout, the inner edge festooned and serrated.

Cephalothorax densely granulated, the space between the lateral and frontal eyes rather swollen.

First lower abdominal segment entire, rounded posteriorly.

*Structure, ♀.* Cheliceres much shorter than in the male but similarly punctured, etc.; second joint with five sharp distinct teeth on the front and internal edges and two spines below; third joint with one long spine below; fourth joint with a spine below and a triangular apophysis with a few spines or teeth on the inner edge and densely serrated on the outer; fifth joint narrow and feeble, fixed finger triangular, serrated on both edges, movable finger curved, sharply pointed and serrated on the inner surface.

First lower abdominal segment entire, sharply protruding posteriorly in a blunt point.

This species is very common at Thayetmyo in Burma being found under stones and bricks and in mud walls. Mr. D. K. Macdonald of the Public Works Department collected large numbers of this animal for me at that place.

## 10. THELYPHONUS RANGUNENSIS, n. sp.

♂. Cephalothorax, cheliceres, and abdomen deep black; coxæ and femora of all the legs reddish brown, remainder of legs deep red; beneath, the cheliceres dark reddish-black; sternum and legs deep red; abdomen deep reddish-brown.

♀. Of precisely the same colour as the male.

*Immature animal.* Cheliceres deep reddish-brown turning to red at the tips; cephalothorax and abdomen nearly black; coxæ and femora of all the legs and the tibial joint of the first pair of legs deep olive-green, remainder of legs pale red.

Length 1 inch; cheliceres, '45 in the male, '35 in the female.

*Structure, ♂.* Second joint of cheliceres sparingly punctured, with a few obsolete teeth on the front and interior margins and two spines below, of which one is very large and one very small; the exterior upper corner wrinkled; third joint rather closely punctured on the upper and outer sides, granulated within, with one tooth below; fourth joint nearly smooth, very broad, no spine below, apophysis very long, cylindrical, and of nearly equal width throughout, slightly wider near the extreme tip; fifth joint large, nearly smooth, fixed finger triangular, serrated on both edges, movable finger curved, sharp-pointed, and serrated within.

Cephalothorax densely granulated all over, the space between the lateral and frontal eyes slightly prominent and absolutely ridged.

First lower abdominal segment entire, with the margin posteriorly rounded.

*Structure, ♀.* Cheliceres short; second joint with two spines below and five sharp, distinct ones on the front and inner edges, sparingly punctured all over but not wrinkled; third joint sparingly punctured all over with a spine on the inner surface; fourth joint with a few punctures, a spine below, and a triangular apophysis with a few large teeth on the inner edge and serrated on the outer edge; fifth joint sparingly punctured and serrated on the inner edge, fixed finger triangular and serrated on both edges, movable finger short and curved and serrated within.

Cephalothorax as in the male.

First abdominal segment below sharply produced posteriorly, entire.

This species is very common in Rangoon and the whole district round, being found under old timber, stones, and bricks.

## 11. THELYPHONUS SYLVATICUS, n. sp.

♂. Cheliceres pitchy black; cephalothorax and abdomen dull

black; first pair of legs and the coxæ and femora of the other legs very dark red, remainder of the legs bright red.

♀. The adult female is unknown, but will, without doubt, be found to have the same coloration as the male in respect to the legs.

*Immature animal.* Cheliceres pinkish brown; cephalothorax and abdomen dull blackish; coxæ and femora of all the legs deep olive, the other parts of the legs pale rufous.

Length .9 inch; cheliceres, .4 inch.

*Structure, ♂.* Cheliceres very slightly punctured, nearly smooth; second joint wrinkled on the exterior front corner with a few obsolete teeth on the front and interior edges, varying in number, one spine below; third joint without any spine; fourth joint broad with no distinct spine below, apophysis long, the first half very narrow and cylindrical, suddenly widening out to double the width on the terminal third; a tumid process on the interior surface near the tip; fifth joint fairly large, greatly sinuated on the interior edge, fixed finger triangular, smooth on the inner edge, serrated on the outer; movable finger sharply curved, and pointed, serrated on the inner edge.

The cephalothorax is densely granulated and the first abdominal segment entire and rounded posteriorly.

This species which is remarkable for the colour of its legs is no doubt common in the Tharrawaddy District of Burma, but I only procured an adult male and an immature animal of it, the former at Zigon, and the latter at Minhla. They were found in forest.

#### EXPLANATION OF PLATE II.

- Fig. 1. Apophysis of the fourth joint of the cheliceres of *T. indicus* ♂.  
 " 2. " " " " " " " *T. indicus* ♀.  
 " 3. First lower abdominal segment of *T. indicus* ♂.  
 " 4. " " " " " " " *T. indicus* ♀.  
 " 5. Terminal joint of cheliceres of *T. indicus* ♂.  
 " 6. " " " " " " " *T. indicus* ♀.  
 " 7. Apophysis of the fourth joint of the cheliceres of *T. insularis* ♂.  
 " 8. " " " " " " " *T. insularis* ♀.  
 " 9. " " " " " " " *T. sawatilis* ♂.  
 " 10. " " " " " " " *T. wood-masoni* ♂.  
 " 11. Terminal joint of cheliceres of *T. johorensis* ♂.  
 " 12. Apophysis of the fourth joint of the cheliceres of *T. andersoni* ♂.  
 " 13. " " " " " " " *T. assamensis* ♂.
-

## III.—Notes on Indian RHYNCHOTA; HETEROPTERA, No. 5.

By E. T. ATKINSON, B. A.

[Received, May 18th;—Read June 6th, 1888.]

## Subfamily, ACANTHOSOMINA, Stål.

Oefvers. K. V.-A. Förh. (8), p. 32, 39 (1872): En. Hem. v, p. 108 (1876):—*Acanthosomida*, Stål, Hem. Afric., i, p. 33, 219 (1864).

a, b, c, as in Subfam. *Pentatomina* (J. A. S. B., pt. ii, p. 192, 1887).

(d.) Tarsi 2-jointed: scutellum not reaching the middle of the dorsum of the abdomen, generally very narrow at the apex; and furnished with frena extended almost to the apex: tibiæ obtusely rounded, rarely furrowed. It contains those genera of the family *Pentatomido* of Dallas which have the scutellum triangular, subequilateral, or not much longer than broad, not reaching or barely extending beyond the middle of the dorsum of the abdomen, the apical part placed behind the frena, generally small, short, and narrow, the frena generally extended for a distance towards the apex of the scutellum, rarely reaching only the middle of the scutellum, apical margin of corium straight, rarely rounded towards the exterior apical angle, tibiæ obtusely rounded, and the sixth ventral segment, in ♀, rather strongly sinuated at the apex in the middle before the genital valvules.

## Genus MICRODEUTERUS Dallas.

List Hem. i, p. 299 (1851); Walker, Cat. Het. ii, p. 390 (1868): Stål, Oefvers. K. V.-A. Förh., p. 640 (1870): En. Hem., v, p. 110, 112 (1876):—*Acanthosoma*, pt., Herr. Schkff, Wanz. Ins., viii, p. 5 (1848).

Body elongate-ovate: head large, broad, gradually sinuately narrowed behind the middle, sides anteriorly parallel or barely diverging, apex broadly and obtusely rounded, tylus and juga subequal in length: antennæ 5-jointed, basal joint short and stout, not extending beyond the apex of the head, second joint minute, third joint largest, nearly as long as the two following taken together, fourth longer than the fifth: rostrum rather long, reaching the base of the ventral spine; 2 and 3 joints about equal, the fourth shorter, basal joint half concealed within the head: pronotum anteriorly and sides distinctly margined, margins narrowly elevated and smooth, unarmed: scutellum rather small, longer than broad; frena not extending beyond the middle of the scutellum: membrane with longitudinal veins: mesostethial lamina reaching the head: sixth ventral segment, in ♀, furnished, towards the

sides at the anterior margin, with a small cavity or hollow; pectus with a strong ridge, which is more elevated anteriorly, and cut off obliquely at its posterior extremity to make room for the ventral spine which is short, scarcely passing the posterior coxæ.

## 295. MICRODEUTERUS MEGACEPHALUS, Herr. Schöff.

*Acanthosoma megacephalum*, Herr. Schöff., Wanz. Ins., viii, p. 5, t. 251, f. 783 et B (1848), ♀.

*Microdeuterus megacephalus*, Stål, Oefvers. K. V.-A. Förh., p. 640 (1870); En. Hem., v, p. 112 (1876).

♀. Entirely dark ochreous-yellow; finely, impressly punctured: base and apex of scutellum red-brown, the base with four yellow spots (sometimes obsolete): the pronotum somewhat red-brown towards the margin and in the middle: spots on the posterior part of segments of the connexivum and its posterior prolongation, brown with a violet tint: beneath unicolorous. rostrum reaching the end of the second ventral segment; the ventral spine extending as far as the base of the first pair of feet (Herr. Schöff.). Stål notes that the rostrum, at least in the ♂, reaches somewhat the apex of the third ventral segment: the venter with a median ridge is continued up to the apex of the sixth segment, which, in the middle, is a little shorter than the three preceding taken together, and somewhat obtuse-angularly emarginate at the apex: lower margin of the genital segment clothed with long, dense hairs, lateral lobes gradually acuminate. Long, 12 mill.

Reported from Bengal, Calcutta, Sikkim (mihi).

## 296. MICRODEUTERUS DALLASI, n. sp.

*Microdeuterus megacephalus*, Dallas (nec Herr. Schöff.), List Hem., ii, p. 300, t. 10, f. 4 (1851). Walker, Cat. Het. ii, p. 390 (1867): Stål, Oefvers. K. V.-A. Förh., p. 640 (1870); En. Hem., v, p. 113 (1876).

Differs apparently chiefly in the spinose posterior prolongations of the connexivum: these are present, but are much less produced.

Reported from N. India.

## Genus ACANTHOSOMA, Curtis.

Brit. Ent. i, p. 28 (1824): Dallas, pt. List Hem. i, p. 198, 303 (1851); Walker, Cat. Het., ii, p. 392 (1867): Stål, Oefvers. K. V.-A. Förh., p. 368 (1870); (8) p. 39 (1872); En. Hem., ii, p. 61 (1870); v, p. 110, 118 (1876): Distant, Biol. Centr. Am. Rhyn., p. 100 (1879).

Head punctured, small or moderate, flat, triangular, gradually narrowed, narrow at the apex, with the tylus longitudinally impressed;

pronotum levigate, sides immarginate, process of the lateral angles not turning forwards, short, triangular, somewhat depressed: scutellum narrow at the apex, frena extended for a distance towards the apex, apical margin of corium straight: first joint of the antennæ extending beyond the apex of the head: mesostethial ridge high, laminated posteriorly, abruptly lower before the intermediate coxæ, not produced hindwards between them; not or only very slightly extending beyond the anterior margin of the mesostethium, more or less distinctly rounded at the apex: apical angles of the sixth abdominal segment in ♂ rounded at the apex.

#### 297. ACANTHOSOMA PROXIMA, Dallas.

*Acanthosoma proximum*, Dallas, List Hem., i, p. 303 (1851): Walker, Cat. Het. ii, p. 288 (1867).

*Acanthosoma proxima*, Stål, En. Hem., v, p. 113 (1876): Distant, Scient. Res. 2nd Yarkand Miss., p. 7 (1879).

Above brownish or yellowish green: very like *A. hæmorrhoidalis*, Linn., the lateral angles of the pronotum are less prominent, rufous, punctured black: apex of scutellum, black (*Dallas*). Long,  $15\frac{1}{2}$ —16 mill.

Reported from Murree (Panjáb): Rawal Pindi (mihi).

#### 298. ACANTHOSOMA DISTINCTA, Dallas.

*Acanthosoma distinctum*, Dallas, List Hem., i, p. 304 (1851): Walker, Cat. Het. ii, p. 293 (1867).

*Acanthosoma distincta*, Scott, A. M. N. H. (4 s.) xiv, p. 290 (1874): Stål, En. Hem., v, p. 113 (1876): Reuter, Berlin Ent. Zeitschr., xxv, p. 75 (1881): Distant, Trans. Ent. Soc., p. 415 (1883).

♂. Above pale olive-green, rather thickly punctured with black, head pointed in front, finely punctured: pronotum with a transverse impunctate space towards the anterior margin; lateral angles prominent, subspinose, obtuse, ferruginous: scutellum brownish, becoming green towards the apex, with the apex itself whitish, membrane brownish, semitransparent, with a dark line at the base, surrounding the apical margin of the corium: abdomen above red, with the margins bright orange, with a black band at the junction of each segment: body beneath pale testaceous: abdomen with the emargination of the apical segment very deep reaching the middle of the abdomen; the margins spotted with black: legs pale greenish, with the tarsi fulvous. Antennæ rather long, pale greenish, with the two apical joints dusky ferruginous (*Dallas*). Long, 13—13½ mill.

Reported from N. E. India, Murree (Panjáb), Darjiling, Japan.

299. *ACANTHOSOMA DIFFICILIS* Dallas.

*Acanthosoma difficile*, Dallas, List Hem., i, p. 304 (1851); Walker, Cat. Het., ii, p. 399 (1867); Stål, En. Hem., v, p. 113 (1876).

♂. Pale olive-green, tinted red and orange, punctured: head reddish; jugs wrinkled and with a few black punctures: pronotum rather thickly punctured, black; anterior and lateral margins reddish, lateral angles prominent, deep red: scutellum deep orange, with numerous scattered black punctures, disc of corium thickly and rather finely punctured, outer margin orange, rather strongly punctured black: membrane transparent, nearly colourless: margins of abdomen not spotted: body beneath dark orange: abdomen with the apical segment not very deeply emarginate: legs ferruginous-orange: antennæ with the three basal joints somewhat ferruginous (Dallas). Long, 13—14 mill.

Locality unknown.

300. *ACANTHOSOMA DUBIA*, Dallas.

*Acanthosoma dubium*, Dallas, List Hem., i, p. 304 (1851); Walker, Cat. Het., ii, p. 399 (1867); Stål, En. Hem., v, p. 113 (1876).

♂. Closely allied to and hardly distinct from the preceding: differs in having the head anteriorly somewhat rounded: angles of pronotum less prominulous, rounded: third joint of the antennæ black at the apex (Dallas). Long, 13—14 mill.

Locality unknown.

301. *ACANTHOSOMA LAEVICORNIS*, Dallas.

*Acanthosoma laevicorne*, Dallas, List Hem., i, p. 311 (1851); Walker, Cat. Het., ii, p. 399 (1867).

♂, ♀. Above pale yellowish-olive: head triangular, pointed in front, with the tylus passing the jugs, the surface slightly wrinkled, pronotum thickly and rather coarsely punctured; lateral angles produced into long, impunctate horns which are sometimes yellow, horns directed forwards and of the same thickness from the base to near the apex which is acute and slightly recurved: scutellum rather strongly but not very thickly punctured; hemelytra very thickly punctured membrane transparent, brownish: body beneath, orange or pale olive: abdomen impunctate, but very finely wrinkled towards the sides; apex sometimes bright red: legs and rostrum testaceous or pale alive: antennæ testaceous, with the third joint black, except at the base (Dallas). ♂, long, 15—16; ♀, 21 mill.

Locality unknown.

302. *ACANTHOSOMA FORFEX*, Dallas.

*Acanthosoma forfex*, Dallas, List Hem., i, p. 308 (1851); Walker, Cat. Het., ii, p. 394 (1867); Stål, En. Hem., v, p. 115 (1876); Distant, Scien. Res. 2nd Yarkand Miss., p. 7 (1879).

♂. Elongate, above pale olive-green, rather densely and strongly punctured black: head pale, with a few fine black punctures; the apex somewhat pointed, with the tylus longer than the juga; eyes black: pronotum with the lateral angles prominent, forming a short, obtuse spine on each side; two yellowish impunctate patches close to the anterior margin, the lateral margins and angles reddish brown: scutellum with the disc reddish brown, with a yellowish, impunctate, median, longitudinal line; the lateral margins and the apex olive-green: membrane transparent, brownish. Body beneath, pale greyish green, tinted with red: abdomen impunctate, obtusely ridged in the middle; sexual organs greatly developed, the lateral pieces produced into two curved processes of a bright orange colour, bearing a small brush of hair at their apices, and nearly as long as the abdomen: the internal pieces black at the tip: prostethium densely and finely punctured: legs pale yellowish-green, with the tips of the claws black: rostrum testaceous, extreme tip pitchy black: antennæ pale yellowish-green, becoming brown towards the apex (*Dallas*). Long,  $12\frac{1}{2}$  mill.

Reported from N. India: Murree.

303. *ACANTHOSOMA ELONGATA*, Dallas.

*Acanthosoma elongatum*, Dallas, List Hem., i, p. 309 (1851); Walker, Cat. Het., i, p. 394 (1867); Stål, En. Hem., v, p. 115 (1876).

♀. Elongate, above yellowish-green, punctured with black: head slightly rugose, impunctate, somewhat pointed in front, with the tylus longer than the juga: eyes black: pronotum yellowish-green in front, reddish behind, coarsely and rather thickly punctured with black, with the exception of a transverse band near the anterior margin; lateral angles produced into strong, deep crimson spines, with the apex obtuse: scutellum coarsely but sparingly punctured with black, and with a reddish-brown, triangular mark in the middle of the base: coriaceous portion of the hemelytra reddish internally, the outer margin and the greater portion of the apex, yellowish-green; the whole surface densely and strongly punctured with black and somewhat rugose: membrane brownish transparent: body beneath, bright yellow, shining: abdomen impunctate, with a strong median ridge; sexual organs much developed, but much less so than in *A. forfex*; lateral processes bright red; pieces flat, yellow, widened, emarginate at the tip which is black: prostethium



with a few black punctures; posterior margin of the metastethium thickly and finely punctured: legs greenish-testaceous with tarsi dusky, and the tips of the claws black: tip of the rostrum, blackish; antennæ with the basal joint greenish-testaceous: the remainder brown, becoming darker towards the apex (*Dallas*). Long,  $14\frac{1}{2}$  mill.

Reported from N. India.

### 304. ACANTHOSOMA (?) BINOTATA, Walker.

*Acanthosoma binotata*, Walker, Cat. Het., ii, p. 895 (1867).

Testaceous, elongate-oval, roughly punctured; punctures brown: head elongate, smooth in front; tylus hardly extending beyond the jugs: rostrum extending to the last coxæ; tips black: antennæ slender, less than half the length of the body; joints successively increasing in length; first extending a little in front of the head: pronotum in front with a smooth band, of which the fore border is a curved pale testaceous line; sides and a slender stripe, pale testaceous; hind angles forming two long, acute, slightly recurved, spines: scutellum with a slender pale testaceous stripe, on each side of which there is a brown patch; tip also brown: pectoral ridge well developed: abdomen beneath slightly ridged, with two incomplete macular brown stripes; spine extending to the intermediate coxæ: hemelytra clouded with brown, around a smooth, transverse, pale-testaceous spot on the disc; membrane cinereous (*Walker*). Long,  $6\frac{1}{2}$ —7 mill.

Reported from India; differs from *C. punctata*, Dallas, by the thoracic spines.

### 305. ACANTHOSOMA ASPERA, Walker.

*Acanthosoma aspera*, Walker, Cat. Het., ii, p. 395 (1867): Distant, Scien. Res. 2nd Yarkand Miss., p. 7 (1879)

Testaceous, elongate-oval, thinly and roughly punctured; punctures mostly black: head elongate; tylus extending very little beyond the jugs: rostrum extending a little beyond the hind coxæ; tip black: antennæ slender, a little more than half the length of the body; first joint extending a little beyond the front of the head; second as long as the third; fourth a little shorter than the third; fifth black, testaceous towards the base, shorter than the fourth: hind angles of the pronotum forming two red, long, stout, acute, very slightly recurved and ascending, spines: pectoral ridge much developed: abdomen beneath slightly ridged; spine extending to the intermediate coxæ: legs rather slender: membrane cinereous (*Walker*). Long, 9—9½ mill.

Reported from India, Murree.

306. *ACANTHOSOMA* (?) *TRUNCATULA*, Walker.*Acanthosoma truncatula*, Walker, Cat. Het., ii, p. 396 (1867).

Testaceous, broad, nearly oval, roughly punctured: head mostly smooth; tylus extending very little beyond the jugs: rostrum extending to the last coxæ; tip black: antennæ slender, about half the length of the body; first joint extending beyond the front of the head; second as long as the third: pronotum with a smooth band in front, and with a slender paler stripe; hind angles forming two long, stout, hardly acute, directly diverging horns: pectoral ridge well developed: abdomen beneath smooth, slightly ridged; spine extending to the intermediate coxæ: legs rather slender: membrane cinereous (*Walker*). Long, 6½ mill.

Reported from India.

307. *ACANTHOSOMA* (?) *IMMUNDA*, Walker.*Acanthosoma immunda*, Walker, Cat. Het., iii, p. 573 (1868).

Reddish testaceous, elongate-oval, roughly and rather thinly punctured: head elongate, triangular, blackish above, excepting the sides, which are reddish and slightly elevated: eyes red: antennæ testaceous, more than half the length of the body; first joint extending beyond the front of the head; second longer than the first and than the third; fourth a little longer than the third; fifth piceous, luteous at the base, longer than the fourth: pronotum with two stout acute spines which are black towards their tips and are nearly as long as half the breadth of the pronotum: scutellum with a black stripe, which is abbreviated towards the base: sternal ridge deep: ventral spine extending to the intermediate coxæ: legs testaceous, slender: membrane pale cinereous, with a broad blackish stripe (*Walker*). Long, 7½ mill.

Reported from India.

308. *ACANTHOSOMA* (?) *ALATICORNIS*, Walker.*Acanthosoma alaticornis*, Walker, Cat. Het., iii, p. 573 (1868).

Tawny, elongate-oval, shining, roughly punctured: head elongate, slightly acute; sides reflexed: eyes piceous, not prominent: rostrum extending to the last coxæ; tip black: antennæ piceous, slender; first and second joints testaceous; first extending much beyond the head, second as long as the third; fourth longer than the third; fifth shorter than the fourth: pronotum pale testaceous along each side in front, with a broad testaceous band between the horns which are as long as the intermediate breadth and are broad and linear from the base to near the

tips, where they are black, dilated and recurved; scutellum less than half the length of the abdomen: pectoral ridge pale testaceous, extending to the head: abdomen ferruginous, pale testaceous along each side, black at the tip; beneath with a pale testaceous stripe; ventral spine pale testaceous, lanceolate: legs slender, pale testaceous: hemelytra pale testaceous towards the base and along the hind border, and with a large pale testaceous apical spot which extends to the costa; membrane brown: wings cinereous (*Walker*). Long,  $11\frac{1}{2}$  mill.

Reported from India.

### 309. *ACANTHOSOMA* (?) *NIGRICORNIS*, Walker.

*Acanthosoma nigricornis*, Walker, Cat. Het., iii, p. 574 (1868).

Tawny, elongate-oval, roughly and thinly punctured, testaceous beneath: head slightly acute, transversely and finely striated; sides reflexed: eyes piecous, not prominent: rostrum extending to the intermediate coxae, tip black: antennae black, slender; first and second joints tawny; first extending much beyond the front of the head; second a little longer than the third, fourth longer than the second and than the fifth: pronotum with a transverse callus on each side in front; horns black, stout, shorter than the intermediate breadth, very slightly curved backward, tapering from the base to the tips, which are slightly rounded: scutellum very slightly ridged, less than half the length of the abdomen, much attenuated at the tip, which is rounded: pectoral ridge deep, extending to the head: abdomen black towards the tip above, ventral spine extending to the middle coxae. legs testaceous, slender: hemelytra with a brown costal stripe, which widens towards the tip; membrane brown: wings brownish cinereous (*Walker*). Long  $14\frac{1}{2}$  mill.

Reported from India.

### Genus *SASTRAGALA*, Am. & Serv.

Hist. Nat. Ins. Hém., p. 155 (1813). Includes *Acanthosoma*, pt., Dallas, List Hem., i, p. 303 (1851): Stål, Oefvers. K. V.-A. Forh., p. 638 (1870); En. Hém., v, p. 110, 113 (1876).

Pronotum anteriorly levigate; within the levigate and more or less distinctly elevated apical margin with fewer punctures, which are placed in a row sometimes confused or here and there double; process of the lateral angles obtusely rounded, horizontal, not turning forwards: scutellum narrow at the apex: apical angles of sixth abdominal segment, in ♂, straight or somewhat acute, not rounded: mesostethial ridge not produced hindwards, not, or but very slightly, extending be-

yond the anterior margin of the prostethium, more or less distinctly rounded at the apex.

### 310. *SASTRAGALA UNIGUTTATA*, Donovan.

*Cimes uniguttatus*, Donovan, Ins. Ind. Hem., t. 8, f. 5 (1800).

*Acanthosoma uniguttatum*, Dallas, List Hem., i, p. 311 (1851); Walker, Cat. Het., ii, p. 394 (1867).

*Sastragala uniguttata*, Stål, En. Hem., v, p. 113 (1876); excl. syn. Distant, A. M. N. H., (5 s.) iii, p. 45 (1879).

♂. Pronotum with acute spines, ferruginous; scutellum marked with a large white dot (*Donov.*).

Donovan's figure agrees best with the description of *S. heterospila*, Walker, except that the latter has a black band or line between the lateral angles.

Reported from Madras, Assam.

### 311. *SASTRAGALA LINEATA*, Dallas.

*Acanthosoma (Sastragala) lineata*, Dallas, Trans. Ent. Soc., v, p. 104 (1849); Walker, Cat. Het., ii, p. 396 (1867); Stål, En. Hem., v, p. 115 (1876).

Above dusky testaceous, strongly punctured with brown: head yellow, with a brown line on each side of the tylus, and a row of brown punctures on each of the jugs; eyes brown: pronotum with the lateral spines acute, slightly recurved, pitchy brown; a transverse band near the anterior margin, and a narrow longitudinal line along the middle of the pronotum impunctate, yellow: scutellum, yellowish brown, paler towards the apex, and with a yellow spot in the middle of the base: hemelytra dusky testaceous, thickly and strongly punctured, the apex yellowish; a short, transverse, impunctate, orange band, near the outer margin, considerably beyond the middle, directed towards, but not reaching, the internal angle; membrane transparent, faintly clouded with brown: abdomen above deep red, the margins yellowish; head pronotum and abdomen beneath, with the legs, rostrum and antennæ testaceous; the antennæ rather darker; ventral spine short, scarcely reaching the intermediate legs (*Dallas*). Body long, 7 mill.

Reported from Sikkim.

### 312. *SASTRAGALA BINOTATA*, Distant.

*Sastragala binotata*, Dist., Trans. Ent. Soc., p. 353, t. 12, f. 12 (1897).

Apex above brownish ochraceous; corium with the lateral margins—widened into a spot in the middle—dull ochraceous, inwardly shaded blackish, membrane bronzy: head transversely wrinkled: antennæ

ochraceous, third joint much longer than the second: pronotum and scutellum sparingly and coarsely punctured, the corium more thickly punctate: lateral angles of pronotum produced into long, somewhat conical spines, their apices subacute, and very slightly reflexed hindwards: body beneath and legs ochraceous; apex of rostrum pitchy (*Dist.*). Long, 13; exp. angl. pron. 10 mill.

Reported from Sikkim (mihi).

### 313. *SASTRAGALA RUFISPINA*, Distant.

*Sastragala rufispina*, *Dist.*, *Trans. Ent. Soc.*, p. 325 (1887).

Body above dark ochraceous, pronotal angles purplish red: head finely and transversely wrinkled, apical part of tylus foveated and excavated: pronotum, scutellum and corium somewhat sparingly and coarsely punctate: lateral angles of the pronotum produced in obtusely pointed spines: membrane pale hyaline, blackish at the base: body beneath very pale ochraceous, legs a little darker in hue: apex of the rostrum pitchy, reaching second abdominal segment; last abdominal segment with two small black spots at the apex: pronotal spines red, beneath as above (*Dist.*). Long, 17; exp. angl. pron., 11 mill.

Reported from N. India.

### 314. *SASTRAGALA MUSTELINA*, Distant.

*Sastragala mustelina*, *Dist.*, *Trans. Ent. Soc.*, p. 352 (1887).

Body above ochraceous; membrane pale brownish; connexivum with the segmental spines black: antennæ ochraceous, apical half of third joint infuscate, third joint much longer than the second; head somewhat obscurely transversely wrinkled, eyes pitchy: pronotum, scutellum and corium coarsely punctate: lateral angles of the pronotum produced into long, straight, somewhat conical, subacutely pointed spines; body beneath, rostrum and legs coloured as above: extreme apex of rostrum pitchy (*Dist.*). Long, 13; exp. angl. pron., 11 mill.

Reported from Naga Hills (Assam).

### 315. *SASTRAGALA HETEROSPILA*, Walker.

*Acanthosoma heterospila*, *Walk.*, *Cat.*, ii, p. 804 (1867)

Testaceous, elongate-oval, roughly punctured. head and fore-part of the pronotum with a reddish tinge; elongate, tylus extending very little beyond the jugs; rostrum extending a little beyond the hind coxæ; tip black: antennæ slender, about half the length of the body; first joint extending beyond the front of the head; second much shorter than the third;

fourth longer than the third: pronotum with a black band, which occupies the hind border and includes the hind angles; these form two long acute directly diverging spines: scutellum black, with a large luteous spot in the disc; tips whitish: pectoral ridge well developed: abdomen slightly ridged beneath; spine extending to the intermediate coxæ: legs rather stout: hemelytra black along the hind border and irregularly black along the outer border; membrane brown, cinereous along the outer border, including a white costal spot at its base (*Walker*). Long  $9\frac{1}{2}$  mill.

Reported from the Panjab: Bunkoti in Jaunsar, 9000 feet (mihi).

### 316. *SASTRAGALA PARMATA*, Distant.

*Sastragala parmata*, Distant, Trans. Ent. Soc., p. 353 (1887).

Body above brownish-ochraceous; spines on pronotum reddish-brown; scutellum with a large cordate ochraceous spot, surrounded with blackish; antennæ ochraceous, 3-4 joints subequal in length, a little shorter than the fourth: eyes purplish-brown: pronotum sparingly and coarsely punctate, the lateral angles produced into long, thick, rounded spines, very slightly reflexed at the apices: scutellum with the median spot levigate, remainder coarsely punctate, apex ochraceous; corium coarsely punctate, with the lateral margin luteous and levigate: body beneath and legs ochraceous; apex of rostrum pitchy (*Dist.*). Long, 12; exp. angl. pron., 9 mill.

Reported from N. India.

### Genus *ANAXANDRA*, Stål.

En. Hem. v, p. 110, 113 (1876).

Mesostethial ridge long, rather prominent to a distance before the anterior margin of the prostethium, with the apical part before the same margin prominulous, gradually narrowed or acuminate: process of the lateral angles of the pronotum turning outwards, slightly upwards and distinctly forwards, pronotum at the anterior margin with punctures arranged confusedly in somewhat like two rows; apical angles of the sixth segment of the abdomen, in ♂, somewhat obtuse.

### 317. *ANAXANDRA RUFESCENS*, Dallas.

*Acanthosoma rufescens*, Dallas, List Hem., i, p. 311 (1851); Walker, Cat. Het., ii, p. 399 (1867).

*Anaxandra rufescens*, Stål, En. Hem., v, p. 114 (1867); Reuter, Berlin. Ent. Zeitschr., xxv, p. 77 (1881).

♀. Head dull olive, impunctate, pointed in front, with the vertex

orange: pronotum with the anterior portion olive, rather coarsely but sparingly punctured with black, and with a broad, impunctate, orange band near the anterior margin; posterior portion ferruginous, rather thickly punctured with black; lateral angles produced into long, acute, red spines, which are directed a little forwards, but have the apex slightly turned back; the basal portion of these spines is coarsely punctured with black, the apex smooth. Scutellum ferruginous olive, sparingly and irregularly punctured with black; the apex testaceous: hemelytra thickly and rather strongly punctured with black, with the outer margin, as far as the submarginal vein, olive; membrane transparent, brownish: body beneath orange; pectus yellowish; abdomen with the posterior angles of the last segment, and the posterior margins of the intermediate and apical vulvar plates, bright red; legs pale yellowish olive, with the base of the femora and the tarsi orange-testaceous: rostrum short, testaceous: antennæ pale olive (*Dallas*). Long, 16—17 mill.

Reported from India, Darjiling (mihi).

### 318. *ANAXANDREA CORNUTA*, Dallas.

*Acanthosoma cornutum*, Dallas, Trans. Ent. Soc., v, p. 193, t. 19, f. 6 (1849); List Hem., i, p. 312 (1851); Walker, Cat. Hel., ii, p. 391 (1857).

*Anaxandrea cornuta*, Stål, En. Hem., v, p. 111 (1876).

♂, ♀. Above olive, slightly clouded with yellowish, rather thickly and strongly punctured: pronotum with the lateral angles strongly cornuted; the processes being more darkly coloured than the rest of the surface: the antero-lateral margins of the pronotum beneath are greenish: scutellum acute, slightly sinuated on each side, immediately before the apex; hemelytra thickly and strongly punctured; membrane brownish at the base, particularly at the internal angles: joints of the antennæ concolorous with the body, the apex, and sometimes the whole of the joints pitchy: legs pale brownish yellow, with the tibiæ and tarsi somewhat darker: ventral spine long, reaching as far as the base of the anterior legs.

♂. With the pronotal processes dark olive green, rounded at the apex, beneath flat, but not grooved: the membrane is pale and semitransparent; the abdomen above red, with broad whitish margins: the body beneath is pale ochraceous, with a reddish tinge towards the apex of the abdomen: ventral spine pale.

♀. With the pronotal processes pitchy, very acute, the apex recurved and tipped with bright orange, strongly channelled beneath; the membrane is brownish; the abdomen beneath pitchy brown, darkest at the apex, and palest on the outer margins and along the median ridge; ven-

tral spine pale, tipped with brown: pectus brownish, with the sternal ridge semitransparent: head beneath brownish (*Dallas*). Long, 13; breadth of pronotum 10 mill.

Reported from Sikkim (mihi).

### 319. *ANAXANDRA NIGRO-LINEATA*, Stål.

*Anaxandra nigro-lineata*, Stål, En. Hem., v, p. 114 (1876).

♀. Olivaceous-flavescent, sparingly punctured above; three apical joints of the antennæ, lateral margins and longitudinal line (anteriorly abbreviated, posteriorly fissured) on the head, longitudinal line on the pronotum before the middle, apical interior spot on the last segment of the connexivum, basal band (posteriorly bisinuate) on the last dorsal segment, and a transverse line on the mesopleuræ, black: flavescent spot on the scutellum, exteriorly and posteriorly margined with black; exterior margin of scutellum punctured in rows at that spot: lateral angles of the pronotum produced in a very long process, sparingly punctured, smooth towards the apex, acuminate and slightly recurved at the apex: dorsum of abdomen sub-sanguineous: membrane slightly infusate, exterior margin (base excepted) deeper fuscous: wings infusate (*Stål*). Body long, 17; breadth of pronotal processes,  $18\frac{1}{2}$  mill.

Reported from India, Darjiling (mihi).

In form and punctuation very like *A. cornuta*, Dallas: pronotal processes longer and turning less upwards.

### 320. *ANAXANDRA SIGILLATA*, Stål.

*Anaxandra sigillata*, Stål, En. Hem. v, p. 114 (1876).

♀. Closely allied to *A. nigro-lineata*, Stål, but smaller, pronotal processes shorter, above black, anteriorly at the apex more strongly rounded, membrane more obscure, exterior limbus pale at the base, margins of the head concolorous, and pronotum without a black longitudinal line; spot on the scutellum at the very narrowly blackish anterior margin sparingly punctured (*Stål*). Long, 13; breadth of pronotal processes, 10 mill.

Reported from India.

### 321. *ANAXANDRA NIGROCORNUTA*, Reuter.

*Anaxandra nigrocornuta*, Reuter, Berlin. Ent. Zeitschr., xxv, p. 77 (1881).

♀. Olivaceous, greenish, head a little, pronotum and scutellum sparingly irregularly, and hemelytra more densely punctured black; head, sutures towards the base of the clypeus, and two approximated



dots on the margin of the vertex, black; apical half of third joint of the antennæ and two last joints, black; anterior band on the pronotum and its sides posteriorly towards the angles, base of scutellum, clavus towards the apex and corium at the claval suture, ferruginous; lateral angles of pronotum produced outwards in a very long horn, entirely black up to the sparingly punctured apex, acuminate at the apex and distinctly recurved, convex on the anterior margin; this horn is as long as the base of the scutellum, slightly rising: membrane smoky with a small whitish dot at the base of the exterior margin: dorsum of abdomen red, apex black, the dorsal genital lobes, in ♀, however, have a red spot; posterior angles of segments of connexivum, black; body beneath pallid. Horns of pronotum beneath olivaceous-virescent-ferruginous, punctured black; pectus palely flavescent, colour verging somewhat into ruddy; prostethium punctured, anterior lateral margin virescent, meso- and meta-stethium somewhat smooth: inferior margin of mesostethial plate rounded: venter slightly rufescent, apical angles of the segments of the connexivum, narrowly black: dorsal genital lobes, in ♀, obliquely rounded outward, there before the base abruptly strongly oblique, slightly concave (*Reuter*). Long, 13½ mill.

Reported from Darjiling.

### 322. ANAXANDRA FULVICORNIS, Distant.

*Anaxandra fulvicornis*, Dist., Trans. Ent. Soc., p. 354 (1887).

Body ochraceous, with an olivaceous tinge: anterior lateral margins of the head, a median narrow longitudinal stripe commencing before the apex of the head and ending on the disc of the pronotum, and the lateral margins of the scutellum (united before the apex), black: basal joint of antennæ ochraceous: pronotum with the disc posteriorly coarsely punctate, lateral angles produced into long, slightly ascending, and directed forwards, dull-luteous spines, of which the apices are very slightly reflexed and subacute: basal two-thirds of scutellum luteous, posteriorly rounded, and margined black: corium coarsely punctate and rugulose: membrane brown: body beneath and legs ochraceous: mesonotum with an oblique black line on each side. Closely allied to *A. nigro-lineata*, Stål, but differs in the smaller expanse of the pronotal angles (*Dist.*). Long, 15; exp. angl. pron. 14 mill.

Reported from Sikkim.

### 323. ANAXANDRA TAURIFORMIS, Distant.

*Anaxandra tauriformis*, Dist., Trans. Ent. Soc., p. 354 (1887).

Body above bright castaneous: lateral margins of the head, ante-

rior and lateral margins and posterior disc of the pronotum, lateral margins of the scutellum, lateral margins of the corium and the membrane, ochraceous: 1-2 joints of the antennæ, ochraceous: head transversely wrinkled and with a few dark punctures: eyes greyish-brown, margined inwardly ochraceous: pronotum on the disc sparingly and coarsely, on the anterior margin thickly, punctate; humeral angles produced upwards and forwards into long spines of which the apices are distinctly truncate reflexed hindwards, these spines are sparingly punctate for about half their length: scutellum sparingly and coarsely punctate: corium thickly punctate: abdominal spines above and beneath castaneous, but beneath inwardly margined blackish: body beneath and legs ochraceous (*Dist.*). Long, 15; exp. angl. pron. 14½ mill.

Reported from Khasiya Hills (Assam).

324. *ANAXANDRA HAMATA*, Reuter.

*Anaxandra hamata*, Reuter, Berlin. Ent. Zeitschr., xxv, p. 78 (1881).

♂. Very like *A. rufescens*, Dallas, differs however in the lateral horn of the pronotum, also (in ♂) in anterior margin before the apex itself, being a little more distinctly convex, entirely sanguineous, and especially in the structure of the genitalia in the ♂. First genital segment about one-third shorter than preceding, apical margin slightly sinuate, second segment uncovered on the margin, straight in the middle, with two small bands subvertically placed in the middle itself, shortly but densely fulvous-pilose, apical angle produced in a long, somewhat incurved horn, this horn furnished at the apex with a densely fulvous pilose fascicula, its exterior margin as long as the lateral margin of the preceding segment, inferior margin as long as the margin of the apical segment: *styli* briefly biramoses at the apex, upper ramus narrow and acutely acuminate, apex somewhat curved, inferior broader and more obtuse, abruptly dentately contracted at the apex (*Reuter*). Long with membrane 15 mill.

Reported from Darjiling.

325. *ANAXANDRA COMPACTA*, Distant.

*Anaxandra compacta*, Dist., Trans. Ent. Soc., p. 855 (1887).

Body above ochraceous, with an olivaceous tinge; head with the basal margin, a spot behind each eye, and the margins of the tylus (not reaching the apex), two circular enclosing lines near anterior margin of pronotum, and a large median rounded spot near the base of the scutellum, black: angles of the pronotum, castaneous: both pronotum

and scutellum very obsoletely and obscurely punctate; the corium finely but distinctly punctate: angles of pronotum produced in short, robust spines of which the apices are rounded above and subtruncate: body beneath ochraceous, much tessellated with black: the pronotal spines above castaneous (*Dist.*). Long, 10; exp. angl. pron., 10 mill.

Reported from Sadiya (Assam).

### Genus CLINOCORIS, Hahn, Stål.

Pt. Wans. Ins. ii, p. 70 (1834); Stål, *Oefvers. K. V.-A. Förh.*, xix (8), p. 39 (1872); En. Hem., v, p. 110, 114 (1876). Includes *Sastragala*, Fieber, *Eur. Hem.* p. 78, 327 (1861);—*Elastomastethus*, pt, Fieber, l c., p. 78, 328 (1861)—*Elastomucha*, Stål, A. S. E. F. (4 s) iv, p. 54 (1864); *Oefvers. K. V.-A. Förh.* p. 688 (1870);—*Meadorus*, Muls. and Rey, *Pun. France, Pent.*, p. 315 (1866).

Antennæ 5-jointed, two-thirds of the length of the body, inserted under the margin of the head forwards in a small elevation, the first joint stout and almost as long as the third; the second as long as the fourth but thinner; the third somewhat shorter than the fourth which however is stouter and almost as stout as the rounded fifth joint: rostrum 4-jointed; ocelli small, placed near the posterior margin of the head: corium besides the strong vein on the inner margin, with a longitudinal vein arising at the base and bifurcated before the middle: membrane with a transverse cellule-like vein emitting six longitudinal veins towards the external margin: feet comparatively long and slender. The mesostethial ridge posteriorly is produced hindwards between the intermediate coxæ: the posterior lateral margins of the pronotum are narrowly depressed and slightly amplified; the furrow from the orifices short, or somewhat so: two apical ventral segments in ♀, without a subimpressed, opaque, lateral spot.

### 326. CLINOCORIS RECURVUS, Dallas.

*Acanthonoma recurvum*, Dallas, *List Hem.*, i, p. 310 (1851); Walker, *Cat. Het.* ii, p. 394 (1867).

*Clinocoris recurvus*, Stål, *En. Hem.*, v, p. 114 (1876).

♀. Ovate, above pale olive, punctured with black: head thickly and finely punctured with black, the tylus longer than the jugæ: pronotum thickly and strongly punctured with black; the lateral angles produced into strong, acute, slightly recurved, deep red spines; the disc with a broad, transverse, yellowish white band across the middle: membrane transparent, brownish: margins of the abdomen dull orange, with a black spot at the posterior angle of each segment: body beneath fulvous, punctured with black; the abdomen sparingly and finely, the

pectus more thickly and coarsely punctured: ventral ridge, impunctate, well marked, but not very prominent: legs yellowish testaceous, with the claws black: rostrum testaceous, with the apex black: antennæ testaceous, with the apical half of the fifth joint black (*Dallas*). Long,  $10\frac{1}{2}$  mill.

Reported from N. India.

### 327. CLINOCORIS PUNCTATUS, Dallas.

*Acanthosoma punctatum*, Dallas, List Hem., i, p. 306 (1851); Walker, Cat. Het. ii, p. 393 (1867).

*Clinocoris punctatus*, Stål, En. Hem., v, p. 114 (1876).

♀. Greenish testaceous, coarsely punctured: head punctured with brown; tylus passing the juga: pronotum strongly and closely rugosely punctate, the punctures brown: scutellum triangular, with the apex much attenuated and produced, strongly but not thickly punctured with brown: corium very coarsely punctured, but with a small impunctate patch on the disc a little behind the middle: membrane transparent, colourless: margins of the abdomen with a small spine at the posterior angles of each segment, and with a small black spot on each segment at the posterior margin: abdomen beneath coarsely and sparingly punctured on the sides, the disc impunctate and with a very distinct median longitudinal ridge: pectus thickly and strongly punctured, especially on the sides: legs orange-testaceous: antennæ testaceous, with the two apical joints brown (*Dallas*). Long,  $9-9\frac{1}{2}$  mill.

Reported from N. India.

### 328. CLINOCORIS CRUCIGER, Reuter.

*Clinocoris cruciger*, Reuter, Berlin. Ent. Zeitschr., xxv, p. 80 (1881).

♀. Saturated ochraceous, head with some fine punctures, pronotum, scutellum and hemelytra strongly impressly-punctured: third joint of the antennæ subequal in length to the second, two last equally long, last black, base pallid: anterior lateral margins of the pronotum, with an arch just behind the apical margin, a longitudinal line and another transverse line just behind the middle forming a cross with the former, and lateral angles, impunctate, levigate; these lateral angles straightly, spinosely produced outward, with a distinct spine slightly recurved, not quite acute; membrane hyaline, with a band irregularly streaked fuscous: abdomen above unicolorously ochraceous, beneath with two discoidal bands and a lateral row of spots on both sides, pale yellowish. Rostrum not extending beyond the last coxæ: the part of

the posterior margin of the pronotum between the margin of the corium and angle, equal in length to the remaining part, towards the base much, and towards the angle slightly sinuated, the latter part within the margin of the corium straight, very slightly oblique, whence the basal margin slightly and very broadly sinuate, basal angles very obtuse: scutellum with almost two rows of dots towards the apex which is not quite acute: exterior margin of corium, behind the middle, strongly roundly amplified towards the apex: pectus sparingly, prostethium strongly, punctured fuscous; mesosternal plate much higher towards the apex than before the intermediate coxæ, apex almost extending beyond the prosternum, and apical margin obliquely truncate, inferior margin slightly rounded towards the apex and towards the intermediate coxæ gradually broadly but strongly sinuate. ventral spine reaching the apex of the mesosternal plate: sixth ventral segment, in ♀, emarginate at the apex: apical margin truncate in the middle, folded at the angles of the emargination, superior genital lobes short, very slightly rounded at the apex, contiguous to entire interior margin (*Reuter*). Long, 6½; with membrane, 8 mill.

Reported from Darjiling.

### 329. CLINOCORIS SCUTELLATA, Distant.

*Clinocoris scutellata*, Dist., Trans. Ent. Soc., p. 355 (1887).

Body above ochraceous, thickly and coarsely punctate: spines of pronotum rosy red: scutellum with a blackish median longitudinal band extending from about the base to the middle: antennæ ochraceous: lateral angles of the pronotum straightly produced into subacute spines of which the apices are slightly reflexed hindwards, and the posterior margins are somewhat sinuated: membrane pale hyaline, with reflections of the red upper surface of the abdomen: body beneath and legs ochraceous: sternum coarsely punctate (*Dist.*). Long, 8; exp. angl. pron., 6 mill.

Reported from Naga Hills (Assam).

### 330. CLINOCORIS MACULATA, Distant.

*Clinocoris maculata*, Dist., Trans. Ent. Soc., 355 (1887).

Body above black ochraceous: pronotum and scutellum coarsely but sparingly punctate, corium thickly punctate: spines of pronotum black: corium with a levigate, ochraceous spot on the disc of the apical area: punctuation entirely dark-brownish and the corium is therefore much darker than the pronotum or scutellum: lateral angles of pronotum produced into stout spines of which the apices are subacute

and prominently reflexed, and their posterior margins sinuated: membrane very pale ochraceous, pitchy towards the apex: body beneath apparently ochraceous (*Dist.*). Long, 8; exp. angl. pron. 6 mill.

Reported from N. E. India.

### Subfamily UROSTYLINA, Dallas.

*Urostylidæ*, Dallas, Trans. Ent. Soc., n. s. ii, p. 15, (1852); List Hem., i, p. 313 (1851);—*Urolabidina*, Stål, En. Hem., v, p. 115 (1876).

Antennæ 5-jointed, basal joint extending to a distance beyond the head: rostrum short, scarcely passing the anterior coxæ, basal joint enclosed in a groove: head small, tylus as long as the juga, lateral margins not trenchant; antenniferous tubercles exserted: genitalia generally more or less produced: odoriferous orifices spinose: pectus not sulcated (*Dallas*).

I. Ocelli present.

a. Basal joint of the antennæ nearly as long as the head and the pronotum taken together; antennæ very slender:—2. *Urostylis*.

b. Basal joint of the antennæ not twice the length of the head, much shorter than the head and pronotum; antennæ stouter:—1. *Urochela*.

II. Ocelli wanting:—3. *Urolabida*.

### Genus UROCHELA, Dallas.

Trans. Ent. Soc., n. s., i, p. 2 (1850); List Hem., i, p. 313 (1851); Walker, Cat. Het. ii, p. 410 (1867); Stål, En. Hem. v, p. 115 (1876).

Head small, short, broader than long, abruptly narrowed, just before the eyes; juga and tylus produced, distinct, rounded; tylus longer than the juga; eyes large, prominent, globose; ocelli moderate, situate close to each other at the back of the head; antennæ longer than the body, 5-jointed, inserted in a tubercle which appears beyond the margin of the head, just before the eyes; first joint stoutest, as long as the pronotum, cylindrical, thinner at the base; second about half as long again as the first, and a little stouter than the second; fourth about as long as the first, slender; all clothed with fine short hairs which are longer on the first joint: rostrum inserted close to the anterior margin of the head, short, reaching only to the middle of the mesostethium, 4-jointed, 1 and 3 joints nearly equal, fourth shorter, second longest; the first at its base enclosed in a small groove of the underside of the head; labrum reaching the middle of the second joint of the rostrum, transversely striated. Body broad, very flat above, convex beneath: pronotum trapezoidal, slightly margined laterally, much narrowed in front, the anterior

margin being considerably narrower than the head and eyes: scutellum rather short, triangular, with the sides nearly straight and the apex acute. Hemelytra ample, the coriaceous part larger than the membranous, with the basal half of its outer margin much elevated; a vein which arises from a strongly elevated line at the base, runs about two-thirds the length of the corium, where it emits a branch on its inner side which reaches the base of the membrane, and passing into it, gives rise, after running singly for a short distance, to five veins on the disc of the membrane, of which the two inner and the two outer ones are united at the base before joining the common trunk: the membrane reaches beyond the apex of the abdomen, and has six veins, of which the outer one is very short, placed at the basal angle. Abdomen convex beneath, the margins thin, projecting a little beyond the hemelytra on each side: the anal apparatus, in ♂, consists of two claw-like processes which project nearly as far as the posterior angles of the terminal segment of the abdomen, with their points turned outwards; a small triangular plate is situate at the base of these which it partially covers, and within the cavity appears the apex of a second triangular piece, which is probably the margin of the dorsal portion of the segment; all these parts are clothed with long woolly hairs, which nearly fill the intermediate spaces: in the ♀, the vulvar plates are not remarkable: the pectus is flat; mesostethium broad, placing a considerable interval between the insertions of the anterior and the intermediate feet; on each side of the metastethium close to its anterior margin and near the intermediate coxæ is a small spine directed outwards and forwards, these appear to be perforated on their posterior surface, at about half their length and are evidently formed by the produced margins of the odoriferous apertures: legs moderate, slender, the posterior pair longest; tarsi 3-jointed, 1 and 3 about equal, the second minute (*Dallas*). Distinguished from *Urostylis*, Westw., by its stout antennæ of which the first joint is not much longer than the head.

331. *UROCHELA QUADRIPUNCTATA*, Dallas.

*Urochela 4-punctata*, Dallas, Trans. Ent. Soc. (n. s.) i, p. 3, t. 2, f. 1 (1850); Walker, Cat. Het., ii, p. 410 (1867); Stål, En. Hem. v, p. 115 (1876).

Body elongate-ovate, above ferruginous grey, finely and thickly punctured: pronotum narrowly margined with yellow and with a narrow, impunctate, longitudinal line on the disc, of the same colour; a small black spot on the lateral margin, near the lateral angle: scutellum with a narrow longitudinal yellow line, continuous with that of the pronotum, the lateral margins yellowish: the basal third of the outer margin of the hemelytra and a small line in the yellow basal portion, a spot on the

disc, and another at the middle of the apical margin, black; membrane pale brown, with the veins paler. Connexivum banded with yellow and black; abdomen beneath smooth, impunctate, yellow; a spot on each side of each segment within the stigmata, and another on the lateral margin, black; head beneath, pectus and rostrum, testaceous; the apex of the latter, pitchy: legs dusky testaceous, femora punctured with pale brown: antennæ with the basal joint dusky testaceous, second black, pale at the base, 3-4 joints black, basal portion of the latter, yellowish white (*Dallas*). Long, 9 mill. Type.

Reported from Bhutan, Sikkim; very common on Observatory Hill, Darjiling, at the end of the rains (mihi), and at Mungphu.

### 332. *UROCHELA GUTTULATA*, Stål.

*Urochela guttulata*, Stål, En. Hem., v, p. 115 (1876).

♀. Paley grey-flavescent, above more densely and more distinctly, beneath more remotely and more finely, punctured fuscous; antennæ blackish; first joint altogether or only towards the base, 4-5 joints towards the base, greyish-flavescent: a line on the pronotum and scutellum, more or less distinct, levigate, anterior scars inwardly blackish: hemelytra with a small fuscous spot on the disc and at the middle of the apical margin, sometimes absent: membrane fuscous with small rounded pallid spots, here and there confluent; lateral streak on the pectus and lateral spots arranged in longitudinal rows, black (*Stål*). Long, 12; broad, 5½ mill.

Like *U. quadripunctata*, Dallas, but larger, antennæ shorter and more slender, lateral margins of pronotum dilated, before the middle obtusely roundly-amplified and obsoletely sub-serrate, slightly sinuated in the middle, the levigate line on the pronotum and scutellum much less distinct, sometimes partly evanescent; membrane sprinkled with pallid dots; pectus very distinctly streaked with black.

Reported from Darjiling, Mungphu (mihi).

### 333. *UROCHELA PILOSA*, Stål.

*Urochela pilosa*, Stål, En. Hem., v, p. 116 (1876).

♂. Paley greyish-flavescent, pilose: pronotum, scutellum, hemelytra and proathidium somewhat strongly punctured black, the former further adorned with fine subferruginous dots: 2-5 joints of antennæ black; 4-5 joints flavescent at the base: lateral limb of pronotum and hemelytra also dorsum of abdomen, weakly ferruginous: membrane fuscous-vinaceous: two spots on the hemelytra, a band on the segments of the connexivum, and the circuit of the spiracula, black:



sides of venter, punctulate. The ♂ has the genital segment retuse; sides emitting a process turning upwards, acuminate at the tip, somewhat longer than broad at the base. Long,  $10\frac{1}{2}$ ; broad,  $4\frac{1}{2}$  mill.

Distinguished from the preceding by being somewhat broader, dorsal punctuation stronger, without the ventral spots arranged in rows or the levigate line on the pronotum and scutellum: lateral margins of pronotum anteriorly obtusely rounded, prominent, not sinuated in the middle, (Stål).

Reported from Darjiling.

### 334. UROCHELA BIMACULATA, Dallas.

*Urochela bimaculata*, Dallas, List Hem., i, p. 313 (1851); Walker, Cat., Het., ii, p. 410 (1867); Stål, En. Hem., v, p. 116 (1876).

♀. Head, pronotum and scutellum brownish grey, thickly and finely punctured with black: head with two black streaks on the vertex: pronotum with the lateral margins considerably waved: corium whitish, finely punctured with brown and with numerous scattered coarse black punctures; the middle of the disc with a large brown spot, membrane semitransparent, brownish: margins of the abdomen dark brown, with a yellow line on each of the sutures: body beneath fulvous: abdomen with the disc shining, faintly wrinkled transversely and rather sparingly punctured with black; the sides somewhat opaque, thickly and finely punctured with black; the stigmata and two rows of spots on each side of the abdomen black: pectus rather thickly and finely punctured on the sides, with the sternum nearly impunctate: femora testaceous, very thickly covered with fine black or brown points; tibiae brownish at the apex; tarsi with the apical joint brown: rostrum testaceous, with the tip pitchy: antennae with the basal joint greyish-testaceous, thickly covered with very minute black points; 2—3 joints black; 4—5 black, with the base yellow (*Dallas*). Long, 13—14 mill.

Reported from N. India.

### 335. UROCHELA OBSCURA, Dallas.

*Urochela obscura*, Dallas, List Hem., i, p. 314 (1851); Walker, Cat. Het., ii, p. 410 (1867); Stål, En. Hem., v, p. 116 (1876).

♂. ♀. Above brown, somewhat obscure, densely and finely punctured; head impunctate, black, with a spot on each side within the eyes, a spot on the middle of the vertex, and the apices of the jugs, brown: lateral margins of the pronotum waved, narrowly edged with yellow: scutellum rather coarsely punctured with black, with the basal angles yellowish;

the apex with an indistinct reddish longitudinal ridge: hemelytra clouded with blackish; membrane brown, opaque: margins of the abdomen black, with a yellow line on each of the sutures: body beneath reddish: abdomen impunctate, minutely transversely rugose, with the stigmata black: pectus finely punctured with black on the sides; pectus impunctate, black: legs brownish; femora with brown dots: rostrum brownish testaceous, with the tips pitchy; antennæ with the basal joint pitchy brown, paler at the base; 2—4 joints, black; fifth joint orange, tip black: anal plate, in ♂, is entire, convex, and encloses a second plate, within and above which the sexual organs are visible (*Dallas*). Long,  $10\frac{1}{2}$ —12 mill.

Reported from India.

### 336. *UROCHELA DISCREPANS*, Walker.

*Urochela discrepans*, Walker, Cat. Hot., ii, p. 411 (1867).

Tawny, elongate-elliptical, thinly punctured, a little paler beneath; punctures brown or black: head with a black spot on the hind border; tylus conical, extending much beyond the jugs; rostrum extending nearly to the hind border of the third ventral segment; tip black: antennæ black, more than half the length of the body; first joint extending much beyond the front of the head; second as long as the first; third about half the length of the second; fourth a little shorter than the second; fifth reddish, piceous towards the tip, a little shorter than the fourth: pronotum with four incomplete and irregular black stripes and with black, slightly reflexed sides: scutellum with two broad black stripes, and with a black dot on each fore angle: pectus and under side of abdomen with four rows of black points: hemelytra with two black dots, one on the disc and one on the middle of the outer border: membrane lurid cinereous. Distinguished from *U. bimaculata* by the tylus being more prominent, and the first joint of the antennæ being more slender (*Walker*). Long,  $12\frac{1}{2}$ —13 mill.

Reported from India.

### 337. *UROCHELA PULCHRA*, Distant.

*Urochela pulchra*, Dist., Trans. Ent. Soc., p. 356, t. 12, f. 8 (1887).

Body above ochraceous, shaded, and punctured brownish: head and pronotum brownish, margins of pronotum, olivaceous; antennæ brownish, second joint longer than the first: scutellum olivaceous, with scattered, coarse, brown punctures, with some mottled markings and a spot in each basal angle of the same colour: corium olivaceous, with large, irregular, coarse, brown punctures on inner area; clavus brown-

ish; membrane brownish, apex paler: body beneath brownish, laterally spotted ochraceous; connexivum ochraceous, spotted black: legs ochraceous, femora speckled brownish: apex of rostrum pitchy (*Dist.*). Long, 15 mill.

Reported from Sikkim (Rangbi, mihi).

### 338. *UROCHELA FERRUGINEA*, Distant.

*Urochela ferruginea*, *Dist.*, *Trans. Ent. Soc.*, p. 356 (1887).

Body above brownish ochraceous, very thickly and darkly punctate: eyes and two median lines on head, fuscous: antennæ fuscous, 1-2 joints subequal in length, third very short: pronotum with a median longitudinal line and the margins, narrowly luteous: scutellum with a median longitudinal line, a linear spot at the basal angles, the apex and the margin, narrowly luteous: corium with the margins narrowly, and some longitudinal discal lines luteous: membrane fuscous: connexivum fuscous, with lineate ochraceous spots: body beneath brownish ochraceous, tinged with fuscous, and with fuscous lateral spots, connexivum as above: legs brownish ochraceous, apices of the tibiae and the tarsi fuscous (*Dist.*). Long, 12 mill.

Reported from Assam.

### Genus *UROSTYLIS*, Westwood.

*Pt. Hope*, *Cat. Hem.*, i, p. 45 (1837). *Dallas*, *List Hem.*, i, p. 313 (1851); *Stål*, *En. Hem.*, v, p. 117 (1876).

Antennæ very long and slender, basal joint nearly as long as the head and pronotum taken together: rostrum and pronotum as in *Urolabida*, *Westw.*: body less elongated: ocelli present: membrane with seven longitudinal veins: abdomen, in ♂, simple, not armed with a forceps; in ♀, terminated by a true, corneous, curved, recurved stylus, bifid at the apex.

### 339. *UROSTYLIS PUNCTIGERA*, Westwood.

*Urostylis punctigera*, *Westwood*, *Hopo. Cat. Hem.* i, p. 45 (1837); *Dallas*, *List Hem.* i, p. 315 (1851); *Walker Cat.*, *Hem.*, ii, p. 411 (1867); *Stål*, *En. Hem.*, v, p. 116 (1876); *Distant*, *A. M. N. H.*, (5 s.) iii, p. 45 (1879).

Rufescent-luteous, punctured, above more or less tinted virescent; pronotum with two somewhat large black spots in the middle towards the anterior margin (sometimes absent); hemelytra with a somewhat large black spot in the middle of the corium: antennæ fuscous, base of the fourth joint, luteous: body beneath and feet concolorous (*Westw.*). Body long, 10½ mill.

Reported from Bengal, Nepál, common in Sikkim (mihi), Calcutta.

340. *UROSTYLIS GRACILIS*, Dallas.

*Urostylis gracilis*, Dallas, List Hem., i, p. 315 (1851); Walker, Cat. Hem., ii, p. 411 (1867); Stål, En. Hem., v, p. 116 (1876); Distant, A. M. N. H., (5 s.) iii, p. 46 (1879).

♂. Head impunctate, orange: eyes black: pronotum, scutellum and hemelytra green, rather thickly and finely punctured: membrane semitransparent, brownish: body beneath yellow, legs fulvous; tibiae pale; tarsi brownish: rostrum testaceous, with the tip black: antennae, very long and slender; basal joint orange; second greenish; 3—5 joints brownish, the two latter with the base greenish-white (*Dallas*). Long,  $10\frac{1}{2}$  mill.

Reported from N. India, Sikkim (mihi).

341. *UROSTYLIS PALLIDA*, Dallas.

*Urostylis pallida*, Dallas, List Hem., i, p. 315 (1851); Walker, Cat. Het., ii, p. 411 (1867); Stål, En. Hem., v, p. 117 (1876).

♀. Above pale greenish yellow: head brownish: pronotum finely punctured with brown, with the lateral margins waved: scutellum more strongly punctured with brown than the thorax: coriaceous portion of the hemelytra thickly and finely punctured, with the inner and outer portions of the apical margin black, the median portion yellow: membrane transparent whitish, with a black spot in the inner basal angle: body beneath orange: abdomen with the disc smooth and shining, the sides reddish and faintly wrinkled: legs testaceous; femora covered with brown points, which, towards the apex, form a short line on each side: rostrum yellow with the tip black: antennae with the basal joint testaceous; the remainder pale brown (*Dallas*). Long,  $13\frac{1}{2}$ —14 mill.

Reported from N. India, Sikkim (mihi).

342. *UROSTYLIS NOTULATA*, Dallas.

*Urostylis notulata*, Dallas, Trans., Ent. Soc., (n. s.), ii, p. 16 (1852); Stål, En. Hem., v, p. 117 (1876).

♀. Ovate, pale testaceous: head rather small, triangular, broader than long; impunctate, faintly wrinkled, with a small oblique pit on each side within the eyes; the apex of the lobes and the whole underside of the head, pale yellow; eyes dark brown, ocelli reddish; antenniferous tubercles, brown: antennae clothed with very small whitish hairs; the basal joint testaceous, becoming dusky towards the apex and covered with very minute brown punctures; 2—4 joints brown, the last rather paler; rostrum pale yellow with the extreme tip black: pronotum

broader than long, trapezoidal, with the anterior angles rounded off; pale testaceous, rather thickly punctured with brown, with an abbreviated longitudinal red line on the middle of the anterior portion; the disc with a faint transverse furrow or impression before the middle; the portion between this furrow and the anterior margin elevated; beneath testaceous, finely punctured with brown, and with a pale reddish patch within each antero-lateral angle: scutellum testaceous, rather thickly punctured with brown: meso- and meta-notum beneath, pale fulvous, smooth, impunctate, with a large dull, pale-brown patch on each side. Legs clothed with fine whitish hairs: femora yellow-testaceous, covered with fine brown points; tibiae and tarsi dusky; claws brown: corium testaceous, thickly and rather finely punctured; the punctures pale brown, the apical margin brown, with the median portion yellow: membrane transparent, colourless, with a dark brown spot on the inner basal angle: wings somitransparent, brownish: abdomen above bright red, shining, very finely wrinkled transversely, with a blackish line on each side within the margins: the margins brownish testaceous, edged with brown: abdomen beneath with the disc pale fulvous, flat, shining, finely wrinkled transversely, covered with very minute brown points; the sides red; the margins testaceous (*Dallas*). Long,  $12\frac{1}{2}$ — $13\frac{1}{2}$  mill.

Reported from N. India.

### 343. *UROSTYLIS FUMIGATA*, Walker.

*Urostylis fumigata*, Walker, Cat. Het. ii, p. 413 (1867): var., Distant, Scien. Res., 2nd Yarkand Miss., p. 7 (1879).

Testaceous, fusiform, very finely punctured: head very small: rostrum extending to half the space between the first coxæ and the intermediate pair, apex black: antennæ nearly as long as the body, first joint almost as long as the pronotum, second much longer than the first, third piceous, a little more than half the length of the second, 4-5 piceous, pale testaceous towards the base, fourth a little shorter than the second, fifth much shorter than the fourth: pronotum with a very slight transverse impression; sides very slightly reflexed, abdomen with large apical appendages; the upper segment lanceolate, armed beneath with two spines: membrane brownish cinereous (*Walker*). Long,  $9\frac{1}{2}$  mill.

Reported from Silhat, Murree (Marri).

### 344. *UROSTYLIS PHILOIDES*, Walker.

*Urostylis philoides*, Walker, Cat. Het., ii, p. 413 (1867).

Testaceous-green, fusiform, very finely punctured, testaceous beneath:

head small: rostrum extending almost to the intermediate coxæ, apex black: antennæ a little longer than the body; first joint a little longer than the pronotum, second as long as the first; third black, about half the length of the second, fourth blackish, pale testaceous at the base, a little longer than the second: pronotum with a very slight transverse impression, sides hardly reflexed: scutellum ochraceous towards the tip and with an ochraceous callus on each side at the base; abdomen, in the ♂, with very large apical appendages; two long, stout, slightly ascending spines, above which there are two small spines: hemelytra pale green; membrane lurid-cinereous. Distinguished from the preceding by the longer and more slender basal joint of the antennæ and by the protuberances on the scutellum (*Walker*). Long,  $7\frac{1}{2}$  mill.

Reported from Burma.

345. *UROSTYLIS LOPOIDES*, Walker.

*Urostylis lopoides*, Walker, Cat. Het., ii, p. 414 (1867).

Testaceous, elongate-elliptical, minutely punctured; punctures brown: head small: rostrum extending to half the space between the first coxæ and the intermediate pair: antennæ pubescent, as long as the body; first joint rather stout, as long as the pronotum, second black, testaceous at the base, as long as the first; third black, about half the length of the second; fourth black, whitish for nearly half the length from the base; shorter than the second; fifth whitish, black towards the tip, shorter than the fourth: pronotum with a pale testaceous longitudinal line and with a slight transverse impression, pale testaceous and slightly reflexed on each side and along the fore border; an elongated black point in front of each hind angle: scutellum with a pale testaceous line: legs moderately long and slender: hemelytra with four small brown spots, first and second costal; first near the base, second at a little before the middle, third on the disc; fourth on the middle of the outer border; membrane lurid-cinereous (*Walker*). Long,  $8\frac{1}{2}$ — $9\frac{1}{2}$  mill.

Reported from India.

346. *UROSTYLIS NIGROMARGINALIS*, Reuter.

*Urostylis nigromarginalis*, Reuter, Berlin. Ent. Zeitschr., xxv, p. 85 (1881).

♀. Testaceous, above erectly pallid pilose: pronotum, scutellum, and corium externally sparingly punctured with large impressed ferruginous dots; scutellum with a subtriangular, fuscous spot towards the base, a little more densely punctured; corium internally and towards the apex very finely and obsoletely concolorously punctured, impressed at the claval suture with a row of minute dots, clavus also at the

scutellary margin with a row of strongly impressed dots, lateral margin of corium itself thinly black: membrane hyaline-white, interior and basal margins also excurrent streak on apex of membrane, fuscous. Long,  $12\frac{1}{2}$  mill.

Rostrum reaching somewhat the middle of the mesosternum: antennæ longer than the body, rufous-testaceous, two first joints with long pallid exserted hairs placed close together, third briefly pilose, last sub-glabrous, first joint subequal in length to pronotum and half the head taken together, second joint almost one-third longer than first and a little over  $2\frac{1}{2}$  time longer than third, the third twice shorter than fourth, basal halves of fourth and fifth, pallid; the fifth shorter than the fourth: anterior lateral margins of pronotum ochraceous, finely serrulate, with long pale hairs, slightly reflexed in the middle: prosternum without a median ridge (♀): mesosternum longitudinally obsoletely subsulcate at the base, equally convex on the disc: feet pallid-pilose, apices of the tibiæ and tarsi, ferruginous: sixth ventral segment, in ♀, about two-thirds longer than preceding, apical margin very slightly rounded; dorsal genital lobes seen from above triangular, very slightly rounded on the exterior margin, interior broadly distant with margin subsinuated, impressed on the disc, inward in the form of an arch, red; seen from beneath, elongate, with the apex acutely rounded, interior margin carinate, ventral lobes turning upwards (*Reuter*).

Reported from Darjiling.

#### Genus UROLABIDA, Westwood.

Pt., Hope, Cat. Hem., i, p. 45 (1837); Dallas, List Hem., i, p. 313 (1861); Trans. Ent. Soc. (n. s.) ii, p. 16 (1852) Stål, En. Hem., v, p. 117 (1876). Includes *Urontylus*, pt., Westwood, l. c., p. 45 (1837): *Callisprepes*, White, M. N. H., (n. s.) iii, p. 543 (1839); Trans. Ent. Soc. iii, p. 93 (1842) — *Typhlocoris*, Herr. Schaff., Wana. Ins. v, p. 79 (1839); ix, p. 175 (1850).

Body elongate-ovate, slender, sides parallel, pronotum as broad as the abdomen, posterior angles not prominent: head small, clypeus short: ocelli wanting: rostrum hardly reaching, or extending beyond, the intermediate coxæ: antennæ, in the ♂, very long, slender, longer than the body, 1-2-4-5 joints of equal length, the third joint shorter; antennæ in the ♀ shorter: hemelytra elongate; membrane with twelve very indistinct longitudinal veins: feet elongate, slender: abdomen, in ♂, terminated by two styli bearing a forceps and with a shorter intermediate spine; in the ♀, terminated by a curved, corneous, recurved appendage produced almost to half the length of the abdomen or not produced. Type, *U. tenera*, Westw.

347. *UROLABIDA GRAYII*, White.

*Calliprepes Grayii*, White, Mag. N. H., iii, p. 548 (1839); Trans. Ent. Soc., iii, p. 98 (1841—43).

*Urolabida Grayii*, Dallas, List Hem., i, p. 816 (1851); Trans. Ent. Soc. (n. s.) ii, p. 16 (1851); Walker, Cat. Het., ii, p. 415 (1867); Stål, En. Hem., v, p. 117 (1876).

Virescent-luteous: pronotum with two posterior triangular dorsal spots, and scutellum with two basal spots, red: membrane with an obscure basal line, coriaceous part with a green transverse line at the apex, oblong-elliptical: head small, with a distinct neck, in front slightly trilobed: antennæ placed on the upper side of the head on a slightly projecting lobe, in front of the eyes which are very prominent; first joint not so long as the head and pronotum, ciliated, cylindrical, rather thickest at the tip: a depression between the eyes which narrows and is continued to the back part of the head, the narrowest part being impressed on the sides, no ocelli: rostrum short, not reaching far beyond the first pair of legs, apparently 3-jointed, second joint longer than first and third: pronotum semicircular, not so broad as the hemelytra, somewhat truncated behind, in front emarginate and margined as are also the slightly sinuated distinctly ciliated sides: scutellum as long as head and pronotum together, pointed: hemelytra large, reaching beyond the abdomen; the membrane with seven veins, the two interior veins almost united at the base, the two exterior united at the apex: legs slender, hairy; tarsi 3-jointed, first joint as long as the second and third together, claws furnished with pulvilli: abdomen flat above, slightly convex below, margined (*White*). Distinguished by the genitalia in the ♀ being of the ordinary form and not produced into large forceps-like process. Long,  $14\frac{1}{2}$ ; breadth of pronotum,  $5\frac{1}{2}$  mill.

Reported from Nepal.

348. *UROLABIDA HISTRIONICA*, Westwood.

*Urostylis histronica*, Westwood, Hope, Cat. Hem., i, p. 46 (1837); Walker Cat. Het. ii, p. 411 (1867).

*Typhlocoris semicircularis*, Herr. Schaff., Wanz. Ins., v, p. 79, f. 525 (1839).

*Urolabida semicircularis*, Walker, l. c. p. 414.

*Urolabida histronica*, Stål, En. Hem., v, p. 117 (1876).

Rufescent luteous, punctured; pronotum and hemelytra tinted virescent; pronotum posteriorly with a testaceous semicircle running through the scutellum to its apex, sides of pronotum testaceous; a black spot at the apex of the corium in the middle; antennæ fuscous, varied with fulvous; body beneath concolorous, feet paler (*Westwood*). Body, long,  $10\frac{1}{2}$  mill.



Walker (*l. c. supra*) describes this species as *U. semicircularis*, thus:—Ochraceous, fusiform, very finely punctured: head small; rostrum extending nearly to the intermediate coxæ; antennæ blackish, slender, nearly the length of the body, first joint reddish, as long as the pronotum, second a little longer than the first, remainder successively decreasing in length, fifth joint reddish at the base: pronotum with three bright green patches, one in the middle and one on each side of the hind border; sides slightly reflexed: abdomen and posterior legs, ferruginous: fore legs greenish testaceous; tibiæ black and slightly dilated at the tips; tarsi black at the base: hemelytra with two pale green streaks, and with a deeper green costal streak, an irregular black mark along the outer side; membrane slightly ochraceous; wings pellucid. A variety has the antennæ pale green, joints with blackish tips, first entirely blackish; legs pale greenish testaceous. Distinguished from *U. binotata*, chiefly in the length of the antennæ. Long,  $10\frac{1}{2}$  mill.

Reported from India, Sikkim (mhi), Calcutta.

#### 349. UROLABIDA TENERA, Westwood.

*Urolabida tenera*, Westwood, Hope, Cat. Hom., i, p. 45 (1837), Dallas, List Hem., i, p. 316 (1851), Walker, Cat. Het., ii, p. 414 (1867), Stål, En. Hem., v, p. 117 (1876).

Palely luteous, punctured, pronotum and hemelytra, virascent-luteous, pronotum posteriorly fulvouscent: body beneath, antennæ and feet pallid (*Westwood*). Long,  $14\frac{1}{2}$ —15 mill.

Reported from India.

#### 350. UROLABIDA UNILOBA, Stål.

*Urolabida uniloba*, Stål, En. Hem., v, p. 117 (1876).

♂. Closely allied to *U. tenera*, Westwood, but smaller, antennæ shorter, less slender, first joint as long as the pronotum, extremity of the base of the second joint, all the third joint and apical part of the two apical joints, black: genital segment without a lateral process, median process much shorter, gradually narrowed, abruptly recurved from the base, depressed, above with a transverse tubercle almost in the middle, apex bilobed (*Stål*). Long, 10; broad,  $4\frac{1}{2}$  mill.

Reported from Darjiling.

#### 351. UROLABIDA BINOTATA, Walker.

*Urolabida binotata*, Walker, Cat. Het. ii, p. 415 (1867).

Greenish testaceous, fusiform, very finely punctured: head small;

rostrum extending a little beyond the first coxæ, apex black: antennæ slender, a little longer than the body, first joint as long as the pronotum, second as long as the first, 3-5 joints black towards the tips, 3 shorter than 4, the fourth shorter than 3, fifth shorter than 4: pronotum transversely impressed in front; sides slightly reflexed: abdomen with two apical laminae: hemelytra with a black longitudinal streak extending from the disc to the outer border of the corium: membrane pellucid (Walker). Long, 10½ mill.

Reported from Silhat.

352. *UROLABIDA CHENNELLI*, Distant.

*Urolabida chennelli*, Dist., Trans. Ent. Soc. p. 356 (1887).

Body above reddish ochraceous, marked with black and luteous: head with the median and anterior portions luteous, the eyes fuscous; first joint of antennæ reddish ochraceous: pronotum with a blackish, discal, semicircular line, between which and the base the colour is paler and thickly punctured with fuscous; on the anterior disc are two levigate, luteous spots: scutellum luteous with three black basal spots, one median and one at each angle, a large round, reddish-ochraceous spot divided by a median longitudinal luteous line, and the apical area, distinctly punctured fuscous: corium with the inner claval and the apical margins, black, these black lines outwardly and broadly margined luteous, the costal margin of the same colour: membrane pale hyaline: body beneath and legs luteous, apices of the femora beneath, and apices of the tarsi and rostrum, blackish (Dist.). Long, 15 mill

Reported from Naga Hills (Assam).

353. *UROLABIDA KHASIANA*, Distant.

*Urolabida khasiana*, Dist., Trans. Ent. Soc. p. 357 (1887).

Above luteous with reddish-ochraceous markings, a small black spot at each lateral pronotal angle, and two black spots on the apical margin of the corium: head with some reddish ochraceous markings behind the eyes which are blackish; 1-2 joints of the antennæ, ochraceous: anterior and lateral margins of the pronotum and transverse bands on disc, also lateral margins of the scutellum and the corium, reddish ochraceous: lateral, claval and apical margins of corium luteous, last with two distinct black spots: membrane pale hyaline: body beneath and legs, luteous: apex of rostrum, a spot on apices of femora beneath, and apices of tarsi, black (Dist.). Long, 14 mill.

Reported from N. Khasiya Hills (Assam).

Genus *EURHYNCHOCORIS*, Reuter.

Berlin Ent. Zeitschr. xxv, p. 84 (1881).

Body oblong, parallel, somewhat flattish; head horizontal, equal in length to breadth with eyes; jugs acuminate; almost twice shorter than clypeus, the latter dilated towards the apex, porrect, genae subacuminate at the apex, the superior margin more strongly rounded and a very little longer than the jugs, bucculae twice shorter than the head, laminately dilated towards the apex, very low at the base: rostrum long, slender, reaching almost the apex of the fourth ventral segment, first joint extending beyond the bucculae, second a little less than twice longer than the first, third about one-half shorter than second and as long as the fourth joint first joint of the antennae as long as the head, second almost one-third longer than the first, third twice shorter than second, the prosternum obtusely carinate in the middle, and the mesosternum at the base (*Reuter*).

354 *EURHYNCHOCORIS SPARSIPUNCTATUS*, Reuter.*Eurhynchocoris sparsipunctatus*, Reuter, Berlin Ent. Zeitschr., xxv, p. 85 (1881).

♂. Ferruginous-fuscous, opaque; pronotum somewhat margined at the base by a transversely impressed line, disc obsoletely rugose, irregularly sparingly sprinkled with rather large, impressed, black dots, here and there, however, irregularly formed into black spots: anterior lateral margin very slightly sinuate in the middle, black, testaceous at the basal angles: scutellum with the basal angles, two patches on the disc, and a spot before the apex, black; towards the base, finely and sparingly, towards the apex, strongly and densely, punctured black: clavus with a row of dots here and there abrupt at the scutellary margin; corium with a row of impressed dots at the claval suture and some large black dots close to this suture and many others situate in the exterior area, disc almost impunctate in the middle, several irregular spots on the exterior margin, median spot on the corium and another at the middle of the apical margin, fuscous: membrane fuscous with 6—7 paler veins: pectus with four black-fuscous marginal dots on each side, first in the middle of the side of the prostethium, second in basal angle of mesostethium, and two last on the metastethium: dorsum of abdomen red, connexivum testaceous, segments broadly banded black in the middle, spiracula on the venter placed amid black dots, sides of segments here with a median point and more internally a small streak on the basal margin, black (*Reuter*). Long, 11 mill.

Reported from Silhat.

## Sub-fam. TESSARATOMINA, Stål.

Hem. Afric., i, p. 23, 233 (1864); En. Hem., i, p. 60 (1870):—*Edsundae*, pt., Dallas, List Hem. i, p. 316 (1851).

(a) as in sub-fam. PENIATOMINA (Jour. As. Soc. Ben. pt. II, p. 129, 1887).

(b.) Spiracula of the basal ventral segment not hidden by the posterior part of the metastethium, sides of the basal segment scarcely shorter than those of the second segment.

Stål makes the following sub-divisions of the Asiatic species:—

Tarsi 3-jointed: antennæ 4-jointed, second joint shorter than the two apical taken together: apical margin of corium straight or somewhat rounded: membrano at the base with several areolas emitting longitudinal veins; hamus usually distinct; primary and subtended veins entirely distant: segments of abdomen single.

I. Metasternum much elevated and freely produced forwards: scutellum distinctly produced behind the frena, produced part triangular or spoon-shaped: thorax more or less produced hindwards at base in the middle before the scutellum:—Div. *Tessaratomaria*.

II. Metasternum simple or elevated, never freely produced forwards: scutellum equilateral, narrowly and slightly produced at the apex behind the frena, rounded or truncated at the apex: thorax not produced posteriorly:—Div. *Eusthenaria*.

The other divisions are *Oncomeraria* chiefly from Australia; *Pri-onogastraria* and *Cyclogastraria* from Africa.

## Div TESSARATOMARIA.

## Genus EMBOLOSTERNA, Stål.

\* En. Hem. i, p. 66 (1870).

Allied to *Tessaratomya* Serv., differs in having the head more acute, perpendicular; eyes larger, ocelli nearer the eyes: lateral angles of pronotum cornuted, anterior lateral margins not flattened out, and apical part of scutellum broader. Body large, obovate; head perpendicular, small, triangular, narrow at apex, subacute; lateral margins somewhat straight, jugs much longer than the short tylus and contiguous before it; bucculae much elevated; eyes large, transverse; ocelli very close to the eyes: antennæ short, somewhat slender, first joint on a level with the apex of the head, second joint a little longer than the third, and somewhat shorter than the fourth: pronotum much declined before the middle, posteriorly amplified and produced hindwards, lateral angles produced outward in a depressed horn, anterior lateral margins somewhat straight,

obtuse towards the anterior margin, not flattened out, posterior lateral margins sinuate: scutellum somewhat equilateral, apical part behind the frena broad, somewhat equilateral, slightly concave: apical margin of corium straight, rounded towards the exterior apical angle: hamus present: prostethium furrowed, the margins of the furrow somewhat amplified: mesostethium with a rather high ridge, prominulous between the first pair of coxæ: metastethium elevated, produced anteriorly in a process which is gradually compressly narrowed, gradually increasing in height forwards, roundly truncated at the apex, and abbreviated between the first pair of coxæ, very obtusely sinuated at the base: apical angles of the abdominal segments, acute, prominulous. feet short, rather stout: femora bispinose beneath at the apex: tibiæ furrowed above (*Std.*).

### 355 EMBOLISTERNA TAURUS, Westwood.

*Tessaratomia taurus*, Westw., Hope, Cat. Hem., i, p. 27 (1837)

*Tessaratomia cornuta*, Dallas, List Hem., i, p. 342 (1851), Walker, Cat. Het., iii, p. 462 (1868).

Black, very thinly punctured: corium more castaneous: apex of scutellum luteous. sides of pronotum produced on both sides in a very large, obtuse horn: body beneath fuscons-luteous, feet short; femora bispinose at the apex (*Westw.*). Long, 26-27 mill.

Above chestnut-brown. pronotum anteriorly thickly rugosely punctured, disc moderately punctured and faintly wrinkled transversely: lateral angles produced into broad, blunt horns, convex above and concave beneath; posterior margin much produced over the base of the scutellum of which the apex is broad, golden-yellow: membrane brassy black: body beneath tawny, abdomen opaque with the median ridge and the lateral margins shining, faintly wrinkled: pectus thickly clothed with a fine golden pubescence, with the sutures deep dark brown, legs castaneous; rostrum deep castaneous with the apex black: antennæ pitchy (*T. cornuta*, Dallas). Long, 29½; exp. hum. 22 mill.

Reported from Malacca, Ligor, Borneo, China.

### Genus TESSARATOMA, St. Farg. & Serv.

Enc. Meth., x, p. 590 (1825) Am. and Serv., Hist. Nat. Ins. Hém., p. 164 (1843): Dallas, List Hem., i, p. 340 (1851). Walker, Cat. Het., iii, p. 459 (1868): Stål, Hem. Afric., i, p. 229 (1864); En. Hem., i, p. 68 (1870).

Head somewhat small, triangular, rounded at the apex, flat; the jugs longer than the tylus, and anteriorly contiguous; antenniferous tubercles very slightly prominulous, unarmed; bucculæ rather elevated: ocelli near the eyes: antennæ 4-jointed, short, somewhat stout: rostrum

short, reaching somewhat the middle of the mesosternum, first joint posteriorly extending somewhat beyond the bucculæ: pronotum rather produced posteriorly over the base of the scutellum which is somewhat produced at the apex, hardly covering the interior basal angle of the membrane; frena extended to a distance beyond the middle of the scutellum: the apical margin of the corium rounded towards the exterior apical angle: membrane with several areolas at the base, emitting longitudinal veins: prostethium anteriorly slightly dilated, sinuated behind the eyes, canaliculate in the middle: mesostethium with a robust ridge, furrowed behind the middle: metastethium much elevated, somewhat sinuated posteriorly, produced to a distance anteriorly, the produced part compressly narrowed forwards, extended to the first pair of coxæ, touching the mesosternal ridge: second ventral segment elevated in the middle in an obtuse tubercle, and touching the base of the metastethium: feet robust, femora usually spinose beneath at the apex; tibiæ furrowed above; tarsi 3-jointed (Stål).

### 356. TESSARATOMA NIGRIPES, Dallas.

*Tessaratomia nigripes*, Dallas, 1st Hem., i, p. 341 (1851); Walker, Cat. Het., iii, p. 461 (1868); Stål, Ofvers. K. V.-A. Forh., p. 642 (1870); En. Hem., i, p. 67 (1870).

*Tessaratomia javanica*, var. *nigripes*, Voll., Fann. Ent. Ind. Néerl. p. 26 (1868).

♀. Colour and form of *T. papillosa*, Drury: head with the margins narrowly edged black: lateral margins of pronotum rounded, broadly reflexed: apex of scutellum broad and rounded, hollowed above and black: abdomen above black, somewhat shining, finely wrinkled transversely, margins dark brown; beneath dull red, somewhat opaque, very thickly covered with minute confluent punctures, with the median ridge, the lateral margins and an irregular interrupted band on each side of each segment deep pitchy brown: pectus spotted black: sternal ridge deep chocolate brown: legs, rostrum and antennæ, black (or deep brown), the last long and slender (Dallas). Long, 32-33 mill.

Reported from Java, Philippines, Sikkim (mihi).

### 357. TESSARATOMA MALAYA, Stål.

*Tessaratomia malaya*, Stål, En. Hem., i, p. 67 (1870). Distant, A. M. N. H. (5 a.), iii, p. 45 (1879).

♀. Ochraceous: antennæ, extreme margin of head, rostrum, at least half of the apical part of the scutellum behind the frena, spots on the pectus at the coxæ, and a large transverse lateral spot, also the feet, black or fuscous-piceous: dorsum of abdomen subangineous:

wings fulvescent. Differs from *T. javanica*, Thunb., in its larger size, and especially in having the metastethial process gradually higher forwards, freely prominent anteriorly, not quiescent on the sternum, flattened lateral part of pronotum much and gradually rounded, entirely somewhat reflexed anal valvules, in ♀, as in *T. Javanica* (Stål). Long, 35, broad, 19 mill.

Reported from Malacca, Ligor, Assam, Sikkim (mibi).

### 358 TESSARATOMA JAVANICA, Thunberg.

*Osmia javanica*, Thunberg, Nov Ins Spec ii p 145 (1788) Gmelin, ed. Syst Nat, i (4) p 2158 (1788) Stoll, Punaies, p 9, t 1 f 2, and larva, t 38, f 271 (1788)

*Tessaratomia javana*, Burm. Handb Ent, ii (1), p 350 (1835)

*Tessaratomia proserpa*, Westw Hope, Cat Hem i, p 27 (1837) Walker, Cat. Het, iii p 462 (1868)

*Tessaratomia papillosa*, Blanchard, Hist Ins Hem, p 142 t 6, f 2 (1840)

*Tessaratomia annularis*, Dohrn, Stettin Ent Zeit, xxiv, p 349 (1868) Walker, l c, iii, p 462 (1868)

Var a — *Tessaratomia conspersa*, Stål Trans Ent Soc (3 s) i, p 595 (1868) En H m, i, p 67 (1870) Walker l c, p 462 (1868) includes *stictica*, De Haan

Var b — *Tessaratomia timorensis* Vollen l c p 26 t 3, f 4 (1868) Walker, l c, p 461 (1868)

*Tessaratomia javanica* Am and Serv, Hist Nat Ips Hem, p 16 (1843) Dallas, l c p 340 (1851) Voll, Faune Ent l Arch Ind Neerl iii, p 25, t 3, f 4b (1868) Walker, l c, i, p 461 2 (1868) Stål, En Hem, i, p 67 (1870) .

Varies in coloration from almost ferruginous to light olive brown. In *T. javanica*, the anal segment, in ♂, is truncate at the apex, and the apical angles are rounded in *T. papillosa*, the anal segment, in ♂, is sinuate at the apex and the apical angles acute. In the latter, the lateral anal valvules, in the ♀, are more distinctly sinuate at the apex and less obliquely than in the former, the interior apical angle, too, is acute and tooth-shaped. Thunberg describes this species as — 'glabrous, luteous, anus obtuse, antennæ and feet ferruginous' Stoll describes it — antennæ 4-jointed, black, eyes prominent, distinct margins of pronotum produced forwards, body red-brown with a pectoral spine feet black. When alive entire body beneath covered with a white powdery substance, above of the colour of Russian leather or hazel, anterior margin of the head weakly emarginate between the lobes eyes and ocelli yellowish or glaucous antennæ blackish-violet, pilose lateral margins of pronotum sometimes dilated so far as to form a quadrant apex of scutellum often brown. beneath, entire body, or some patches on the pectus, sternal and abdominal ridges and the margin of the abdomen of a deep blackish brown, or the entire lower surface of that colour feet black-brownish or violet (Voll) The ♀ is smaller, sides of thorax rounded, a little

dilated towards the posterior angles: antennæ and feet fuscous, body beneath and abdomen above more carneous: anus formed of a single quadrate lobe (*T. proxima*, Westw.). Long, 26 mill. The length apparently varies from 25 to 35 mill.

Var. *a*:—*T. conspersa*, Stål, ♂. Testaceous-flavescens, rather densely punctured, above remotely and minutely sprinkled fuscous: pronotum rugosely punctured at the anterior lateral margins which are obtusely roundly subangulated in the middle: metasternal ridge somewhat reaching the first coxæ: femora bispinose beneath at the apex (Stål). Long, 25; broad, 14 mill. Celebes, Java, Arakan (mihi). In the Arakanese specimen, the entire scutellum is black. Vollenhoven makes the apex of the scutellum and the antennæ black; body beneath hardly more obscure: pectus with some transverse brown patches: feet obscure brown-red.

Var. *b*:—*T. timorensis*, Voll.: small; pronotum not dilated, colour hazel, anterior and lateral margins finely rugose: antennæ and feet obscure, almost black. Timor, Sibságar (Assam).

Reported from E. Archipelago, Malacca, Sikkim, Assam (mihi.).

### 359. TESSARATOMA PAPILLOSA, Drury.

*Cimex papillosus*, Drury, Ill. Nat. Hist., i, p. 96, t. 43, f. 2 (1770): Wolf, Ic. Cim., i, p. 12, t. 2, f. 12 (1800): China.

*Cimex chinensis*, Thunb., Nov. Ins. Spec., ii, p. 45, t. 2, f. 59 (1788): Walker, Cat. Het., iii, p. 461 (1868): China.

*Cimex sinensis*, Gmelin, ed. Syst. Nat., i (4), p. 2156 (1788): Japan, China.

*Tessaratomia chinensis*, Guérin, Règne An., Texte, Ins. iii, p. 345 (1829-44): Dallas, List. Hem., i, p. 340 (1851); Walker, l. c., p. 461 (1868): China.

*Tessaratomia sonneratii*, St. Farg. and Serv., Enc. Méth., x, p. 590 (1825): Guérin, l. c., Icon., t. 55, f. 4 (1833): India.

Larva, *Tessaratomia orna-cruenta*, Gray, Griffith, An. King., xv, p. 239, t. 46, f. 1 (1833).

*Tessaratomia papillosa*, Hahn, Wanz. Ins. ii, p. 123, t. 67, f. 204 (1834): Am. and Serv., Hist. Nat. Ins. Hém., p. 16 (1843): Walker, l. c., p. 461 (1868): Stål, En. Hem., i, p. 68 (1870).

Head small, yellowish-olive, eyes of the same colour: antennæ black: pronotum yellow-olive, elevated above the level of the head, sides rather projecting at the ligature of the wings: scutellum triangular, terminating in a point near the middle of the abdomen, upper part of it lying beneath the pronotum: hemelytra opaque, yellow-olive; membrane almost transparent; wings yellow-brown: abdomen above dark red, beneath clay-colour, serrulate on the sides, or with a tooth on each segment: anus terminates in two angular points, with a small spine or cornicle on each side: pectus pale clay colour, having a black



spot directly under the fore-legs and another on each side of the intermediate pair: all the legs brown-yellow: rostrum brown (*Drury*). Long, about 25-26 mill.

Flavescent, anus 4-toothed, sternum porrect (*Gmelin*, l. c.).

♀. Above entirely testaceous: beneath with head and pronotum a little lighter and abdomen a little ferruginous: lateral margins of pronotum almost round, posterior margin truncate, almost straight: sternal process widened, not extending beyond the base of anterior coxæ: abdomen dentate on the sides, last segment with four small angles, the two interior formed by an emargination: all femora beneath with two short spines, placed side by side, a little before the tip (*T. sonneratii*, Serv.). Long, 25-26 mill. Serville observes that he had a specimen of the ♂ in which there was no olivaceous colour, posterior margin of the pronotum yellow, tip of scutellum alone brown: antennæ and feet brown ferruginous. Probably this ♂ belongs to the preceding species. Stål observes that the lateral valvules, in the ♀, are distinctly sinuated at the apex and less obliquely so than in *T. javanica*, the interior apical angle is acute and dentiform.

Reported from China, Java, India. The Indian Museum has specimens from Amoy, Assam, Calcutta.

### 360 TESSARATOMA (?) FURCIFERA, Walker

*Tessaratomia furcifera*, Walker, Cat. Het. iii, p. 463 (1868).

Testaceous: head, pronotum and scutellum thickly and very minutely punctured: head obliquely and finely striated on each side, rostrum piceous; antennæ black, second joint a little longer than the third: thorax with the sides piceous, forming two very much rounded angles, posterior angles rounded: scutellum slightly grooved towards the tip which has a black forked spot: pectus partly black, ridge ferruginous, reaching the fore coxæ: abdomen ferruginous, posterior angles of the apical segment, elongated, acute: legs ferruginous: hemelytra thickly and minutely punctured; membrane pale testaceous-olivaceous. Thorax diverging directly from the head less than in *T. papillosa*, sides of thorax almost angular (*Walker*). Long, 27½ mill.

Reported from Siam.

### Genus SIPHNUS, Stål.

Trans. Ent. Soc. (3 s.), i, p. 597 (1863); En. Hem., i, p. 66 (1870); Walk., Cat. Het. iii, p. 467 (1868).

Body obovate: head rather large, obtusely triangular: antennæ 4-jointed: pronotum somewhat produced posteriorly, posterior lateral margins slightly sinuate: scutellum triangular, narrow at the apex:

metastethium elevated, produced like a horn forwards: feet short, robust, unarmed. Allied to *Tessarotoma*, head larger, pronotum not so produced posteriorly (*Stål*).

### 361. SIPHUS ALCIDES, Stål.

*Siphus alcides*, Stål, Trans. Ent. Soc., (3 s.) i, p. 597 (1868); En. Hem., i., p. 68 (1870); Walker, Cat. Het. iii, p. 467 (1868).

♂. Yellow-castaneous, shining, hemelytra more obscure: antennæ obscurely subæneous, apical joint weaker towards the apex: lateral margins of pronotum and abdomen, also costal margin of hemelytra anteriorly greenish-brassy: membrane fuscous: pronotum one-fifth shorter than breadth, sparingly, distinctly punctured, anterior margin somewhat sinuate in the middle, lateral margins slightly rounded behind the middle, not reflexed, posterior margin slightly rounded: scutellum sparingly, distinctly punctured: hemelytra finely, remotely punctured (*Stål*). Long, 31; broad, 16½ mill.

Reported from Cambodia.

### 362. SIPHUS HECTOR, Stål.

*Siphus hector*, Stål, Trans. Ent. Soc., (3 s.) i, p. 597 (1868); En. Hem., i, p. 68 (1870); Walker, Cat. Het., iii, p. 467 (1868).

♂. Narrowly obovate, weakly castaneous, remotely obscurely punctured: scutellum, antennæ and feet, fuscous-castaneous: apex of two apical joints of the antennæ, apex of scutellum and basal part of femora, yellow-castaneous: hemelytra castaneous, veins sparingly sprinkled flavescent: membrane fuscous: anterior lateral margins of pronotum, margin of abdomen and irregular, transverse spots on venter, arranged in four rows, subæneous-fuscous. Narrower than the preceding, more densely and more distinctly punctured: pronotum one-third shorter than breadth, anterior lateral margins slightly incrassate, straight, anteriorly very slightly rounded, anterior margin slightly somewhat sinuate in the middle, basal margin somewhat straight (*Stål*). Long, 29; broad, 15 mill.

Reported from Malacca.

### 363. SIPHUS DILATUS, Walker.

*Siphus dilatus*, Walker, Cat. Het., iii, p. 467 (1868).

Tawny, elongate-oval: head finely and transversely striated: rostrum extending nearly to the intermediate coxæ; tip black: pronotum and scutellum thin and roughly punctured: pronotum with a very

slight transverse ridge near the fore-border and with a black marginal line extending on each side from the fore-border, to the hind angle which is rounded and prominent: scutellum darker than the pronotum, triangular, acute, abruptly attenuated and slightly furrowed near its tip: pectus testaceous; sternal ridge lanceolate, extending to the first coxæ, its posterior extremity concave, contiguous to the broad, round, ventral spine, abdomen blackish: beneath piceous, very thickly and finely punctured, its middle part longitudinally and very minutely striated; hind angles of the apical segment elongated, acute, not extending so far as the appendages, which are acute: legs piceous; femora tawny at the base: hemelytra piceous, thickly and minutely punctured: wings black (*Walker*). Long, 38½ mill.

Reported from Siam.

#### Genus HYPENCHA, AM. and SERV.

Hist. Nat. Ins. Hém., p. 166 (1843): Stål, En. Hem., i, p. 68 (1870).

Head rather pointed: antennæ a little longer than in the genus *Tessaratomya*, with the joints proportionately more slender and not short, stout and incrassate: rostrum not reaching the insertion of the intermediate feet: pronotum transverse, the posterior angles prominent, though rather rounded; the posterior margin slightly rounded and sinuated, not extending over the base of the scutellum: sternal ridge extended in a point which becomes lower at the insertion of the intermediate feet and advances in the form of a recurved hook, compressed and obtuse, beyond the first pair of feet: scutellum not reaching the middle of the abdomen, its tip canaliculate or spoon-shaped: abdomen oval, not or only very slightly enlarged on each side: feet as in *Tessaratomya* but the internal or posterior spine at the end of the intermediate and last femora is notably more robust than the external or anterior spine: there are apparently no spines at the tip of the first femora: the other characters as in *Tessaratomya* (*Am. and Serv.*).

#### 364. HYPENCHA LUCTUOSA, Stål.

*Hypencha luctuosa*, Stål, Trans. Ent. Soc., (3 s.) i, p. 596 (1863); Stål, En. Hem., i, p. 69 (1870).

*Tessaratomya luctuosa*, Walker, Cat. Het., iii, p. 463 (1868).

♂. Obovate, subæneous black; above sparingly, distinctly, on hemelytra more finely, punctulate; beneath, densely and finely rugulose punctured: apical joint of antennæ (except the base), head beneath and meso- and meta-stethium yellow-testaceous: lateral angles of pronotum hardly prominent. Allied to *H. apicalis*, St. Fag., but

narrower, lateral angles of pronotum rounded, hardly prominent outwards and in no sense forwards: margins of abdomen immaculate: last femora beneath near the apex armed with two spines (*Std*). Long, 28; broad, 15 mill.

Reported from Burma.

365. *HYPENCHA APICALIS*, St. Fargeau & Serville.

*Tessaratomia apicalis*, St. Farg. and Serv., Enc. Méth. z, p. 591: Burm., Handb. Ent., ii (i), p. 351 (1835): Voll., Faune Ent. l'Arch. Ind. Néerl., iii, p. 26 (1838); Walker, Cat. Het., iii, p. 462 (1868).

Var.—*Hypencha reriki*, Elleur., Nat. Tijdschr. Ned. Ind., xxxiv, p. 160, f. 30 (1862); Walker, l. c., p. 462 (1868).

*Tessaratomia picea*, Dallas, List Hem., i, p. 341 (1851).

*Hypencha apicalis*, Am. & Serv., Hist. Nat. Ins. Hém., p. 166 (1843); Stål, En. Hem., i, p. 68 (1870).

♀. Deep pitchy brown, shining: last joint of antennæ ferruginous, black at the base: membrane bronzed: sides of pronotum dilated, rounded, its posterior margin very little advanced over the scutellum, of which the apex is spatulate: sternal ridge elongate, rising at its anterior part and extending beyond the base of the first pair of coxæ: abdomen a little denticulate on the margin, by reason of the posterior angles of the upper segments extending beyond those which follow: last segment with four, almost spinose, angles, the two interior formed by one emargination: all the femora with two spines beneath placed side by side a little before the apex, those of the first pair very short those of the last pair long, like the posterior spine of the middle pair (*Serv.*). Long, 33-34 mill.

Var. ♀. Shining-black or piceous, with very numerous, small, brassy-green impressed punctures on the pronotum and scutellum: hemelytra violaceous black, varied with purple and cærulean: anterior angle of the pronotum unidentate: abdomen attenuated hindwards, with the margin serrated, posterior teeth longer, curved and arcuate: the posterior angle of the scutellum fuscous-brunneous, with a foveola, containing an intumescence: antennæ black, apex of the last joint ochraceous-brunneous: feet piceous: beneath fuscous-black; sternum, neck and face ochraceous (*H. reriki*, Elleur.). Long, 28—29 mill.

Reported from Java, Sumatra, Borneo.

366. *HYPENCHA OPHTHALMICA*, Stål.

*Hypencha ophthalmica*, Stål, Trans. Ent. Soc., (3 s.) i, p. 596 (1863); En. Hem. i, p. 69 (1870).

*Tessaratomia ophthalmica*, Walker, Cat. Het., iii, p. 463 (1868).

♀. Distinctly punctured, obscurely ferruginous, tinted subopreous;

beneath with feet, apex of scutellum and marginal spots on abdomen, sordid testaceous-flavescens: tibiae above margined black: eyes large: lateral angles of pronotum somewhat prominent, anterior lateral margins somewhat straight: last femora beneath with two spines at the apex (Stål). Long, 24; broad, 12 mill.

Reported from Ligor, Malacca.

### Genus PYGOPLATYS, Dallas.

List Hem., i, p. 338 (1851) Walker, Cat. Het., i, p. 459 (1868); Stål, En. Hem., i, p. 69 (1870).

Head not broader than long, somewhat pointed in front, scarcely emarginate with the lateral margins plane: antennæ 4-jointed, rather stout, basal joint not reaching the apex of the head, second joint longer than the third, fourth about equal to the second: rostrum 4-jointed, reaching the middle of the space between the anterior and intermediate coxæ, second joint longest; basal joint very thick, about as long as the fourth, fourth longer than the third: pronotum with the lateral angles produced into broad flat processes, or strong, pointed spines; the posterior margin produced in a semicircle over the base of the scutellum: pectus with a very strong ridge, attached to the metastethium, where it is somewhat pentagonal, deeply emarginate posteriorly for the reception of the ventral spine, produced anteriorly in a long free spine, reaching far forwards and considerably depressed at its apex; mesostethium with a distinct canal in which the apex of the rostrum reposes: scutellum somewhat obtuse at the apex, distinctly channelled: abdomen oblong, nearly as broad at the apex as at the base, projecting far beyond the hemelytra on each side, with the posterior angles of the apical segment produced; vulvar plates very broad; basal plates received in a semicircular emargination in the middle of the apical segment of the abdomen; lateral plates transverse, with their apices acute and with a strong tooth in the middle of their posterior margins; median plates united, forming a single, somewhat quadrate piece, widened behind, with two strong spines on its posterior margin and its lateral angles rather acute; there are thus eight teeth in the space between the posterior angles of the abdomen: legs moderate; femora unarmed; tarsi 3-jointed (Dallas).

### 367. PYGOPLATYS ACUTUS, Dallas.

*Pygoplatys acutus*, Dallas, List Hem., i, p. 340 (1851); Walker, Cat. Het., iii, p. 460 (1868); Stål, En. Hem., i, p. 69 (1870).

*Pygoplatys rousus*, Voll., Faun. Ent. l'Arch. Ind. Néer., iii, p. 24, note, (1868).

♀. Above pale brown, thickly and rather strongly punctured: pro-

notum with a long, stout, acute spine on each side: margins of abdomen with a brassy-green spot on each segment: body beneath and legs somewhat fulvous; sternal ridge bright fulvous; antennæ pitchy brown (*Dallas*). Long,  $17\frac{1}{4}$ ; breadth of shoulders,  $16\frac{1}{4}$  mill.

Above rosy, except the base of the head and the anterior inclined part of the pronotum which like the body beneath are luteous: posterior part of pronotum punctured black; lateral horns rather long, turning a little forwards, rounded at the apex, (*P. rossus*, Voll.). Long, 18 mill.

Reported from Malacca, Burma.

### 368. PYGOPLATYS MINAX, Vollenhoven.

*Pygoplatys minax*, Voll., Faune Ent. l'Arch. Ind. Néerl., iii, p. 23, t. 3, f. 3 (1868).

♀. Above obscurely fulvous, beneath, luteous-ochraceous: head reddish ochraceous; eyes glaucous, ocelli yellow placed on small, black, cuneiform spots: antennæ of a deeper red, pronotum very broad; lateral angles in the form of horns, rather broad at the base, recurved, diminishing in size towards the tip which is obliquely truncated, their colour is of a deeper red than the disc, marked with small black impressed punctures, the rest of the pronotum is indistinctly punctured, except the transverse part near the anterior margin, posterior margin yellowish: scutellum lightly sprinkled with impressed dots, apex channelled: corium very finely punctured, disc paler; membrane hyaline, colourless: the portion of the abdomen extending beyond the hemelytra is broad, slightly purplish red; the angles of the segments are denticulate and touch almost a submarginal black band: feet and tibiae with a reddish tinge (*Voll.*). Long, 19 mill.

Reported from Borneo: Indian Museum has a specimen from Johore. Possibly *P. ralandii*, Voll. (l. c.), is only a variety.

### Genus AMISSUS, Stål.

Trans. Ent. Soc., (3 s.) i, p. 595 (1863): En. Hem. i, p. 70 (1870).

Body, large, oval: head subelongate; jugæ very long, contiguous before the tylus; bucculae much elevated: ocelli remote from the eyes: antennæ 4-jointed: posterior margin of pronotum roundly produced in the middle above the base of the scutellum, which is itself produced at the apex: apical margin of corium straight, apical angle rounded; membrane furnished at the base with many areolae, emitting longitudinal veins: mesostethium elevated, anteriorly somewhat produced and cleft: metastethium slightly elevated, posteriorly very broadly sinuate: second ventral segment slightly elevated and produced at the base in the

middle: feet somewhat short, femora armed with two spines beneath at the apex: last pair of tibiae about equal in length to the femora: 1-2 joints of tarsi equally long: allied to *Hypencha*, Am. & Serv. but structure of head and of sterna different (Stål).

### 369. *AMIBSUS ATLAS*, Stål.

*Amisus atlas*, Stål, Trans. Ent. Soc., (3 s.) i, p. 596 (1868); Walker, Cat. Het., iii, p. 466 (1868); Stål, En. Hem., i, p. 70 (1870).

♀. Fuscous-castaneous: narrow limbus and posterior part of pronotum, apex of scutellum, homelytra, coxæ, trochanters and margin of abdomen, weakly castaneous: antennæ, veins of hemelytra and the tarsi sub-castaneous-yellow: apical angles of abdominal segments, black: pronotum robustly cornuted: head with the sides subparallel, and slightly sinuate in the middle, subtruncate at the apex, more than twice longer than the breadth: second joint of antennæ somewhat longer than the third, but shorter than the apical: pronotum remotely distinctly punctured, posteriorly somewhat smoother, lateral angles obliquely produced forwards in long, depressed, slightly arcuate horns; anterior lateral margins crenulated: scutellum remotely, distinctly, punctured, smooth at the apex: hemelytra densely punctured, veins smooth: beneath densely alutaceous (Stål). Long, 41, broad, 19 mill.

Reported from Singapore, Tenasserim.

### DIV EUSIENARIA (p. 52).

#### Genus EUSTHENES, Laporte.

Ess. Hém. p. 64 (1832), Am. & Serv., Hist. Nat. Ins. Hém., p. 167 (1848); Dallas, List. Hem., i, p. 342 (1850); Walker, Cat. Het., iii, p. 467 (1868); Stål, Hem. Afric., i, p. 225 (1864), En. Hem., i, p. 71, 230 (1870).

Head almost squarely truncate at the tip: antennæ rather long: pronotum transverse, lateral margins defined, posterior angles prominent but rounded, posterior margin not extending itself over the scutellum: sternal ridge not prolonged beyond the intermediate pair of feet and consisting only of a kind of plate placed between those and the last pair, straightly truncate posteriorly, and rounded anteriorly, narrower in the ♂: scutellum not reaching the middle of the abdomen, its tip ending in a small, almost square and spoon-shaped, prolongation: four vulvar pieces in ♀, square at their tip; anal plate, in ♂, not near so broad as in *Tessaratomia*: feet very robust, first pair rather small, intermediate longer; posterior femora much longer and stouter than the intermediate, especially in the ♂, with a strong hook-like spine at the base; all the femora with two weak spines towards their tips, those of the first pair hard-

ly visible: posterior tibiae, in ♂, strong, curved inside at their base; tarsi strong and large, second joint almost as large as the third (*Am. & Serv.*).

a. First pair of femora beneath near the apex unarmed or furnished on both sides with a small spinule: intermediate femora beneath, near the apex, with a moderate or small distinct spine: mesostethial ridge or wrinkle depressed, often broadly and distinctly furrowed, posteriorly broader, convex and more elevated: metastethium anteriorly narrowed, not however compressed, touching the elevated base of the mesostethial ridge, posteriorly not or but very slightly inflexed: second ventral segment more or less elevated in the middle, usually touching the base of the metastethium.

b. Feet obscurely piceous or piceous-black: wings usually obscurely fuscous and slightly tinged violaceous.

c. Tarsi and feet concolorous; spiracula cinctured flavescent. *E. robustus*, St. Farg., and *E. scutellaris*, Herr. Schöff.

cc. Tarsi pale castaneous or yellow-castaneous; wings somewhat violaceous-fuscous.

*E. hercules*, Stål; *E. cupreus*, Westwood, *E. curytus*, Dist.

bb. Feet, a great part of the first joint of the antennæ and the apex of the scutellum, weakly castaneous: last pair of femora sometimes fuscous-castaneous.

*E. polyphemus*, Stål.

aa. Fourth joint of the antennæ, yellow-testaceous at the base: wings and dorsum of the abdomen black-violaceous: first pair of femora beneath near the apex, with a somewhat robust spine on the anterior side, with a very minute spinule or unarmed, on the posterior side: middle femora near the apex with a rather large spine on both sides: metastethium anteriorly and posteriorly gradually compressly narrowed: second ventral segment not elevated in the middle, not higher than the first segment: apical angles of the abdominal segments not so prominent as in the preceding.

*E. savus*, Stål.

### 370. EUSTHENES ROBUSTUS, St. Fargeau & Serville.

*Tessaratomia robusta*, St. Farg. & Serv., Enc. Méth. x, p. 591 (1825).

*Onormis robustus*, Blanchard, Hist. Ins. p. 142 (1840).

*Eusthenes elephas*, Dohrn, Stettin Ent. Zeit., xxiv, p. 351 (1868); Walker, Cat. Het., iii, p. 468 (1868).

*Eusthenes robustus*, Am. & Serv., Hist. Nat. Ins. Hem., p. 167 (1843); Dallas, List Hem., i, p. 342 (1851); Walker, Cat. Het., l. c. p. 468 (1868); Vollenhoven, Faune Ent. l'Arch. Indo-Néer., iii, p. 27 (1868); Stål, En. Hem., i, p. 71, 230 (1870); Distant, A. M. N. H., (5 s.) iii, p. 45 (1879).

♂. Body broad, blackish-brown: antennæ black: pronotum and



scutellum covered with transverse wrinkles which give it a leathery appearance: apex of scutellum and hemelytra brown-ferruginous: sides of pronotum a little dilated, lateral margins dilated, rounded: abdomen dentate on the margins: annus emarginate: all the femora beneath with two spines, side by side, before the apex; posterior femora long, very stout, having a large, strong and very pointed spine towards their base; tibiæ very arcuate, especially at the base (*Serv.*). The anal plate in the ♂ is short and almost straightly truncate at the tip: in the ♀, the anal plate is bilobed, and also the pronotum is more deeply wrinkled, and the ventral grooves are neither so long nor so deep.

Pronotum distinctly broader than the base of the hemelytra, anterior lateral margins somewhat dilated, distinctly rounded behind the middle, lateral angles distinctly prominent, obtuse: apical part of scutellum produced behind the frena, somewhat broadish, subquadrate, obtusely rounded at the apex, flavescent-castaneous mesostethial wrinkle or ridge posteriorly convexly elevated: the metastethium not pallescent, at least in ♀, narrowed somewhat forwards before the middle, behind the middle, first narrowed somewhat hindwards, then furnished with parallel sides, truncated at the base, broader at the base than at the apex: second ventral segment elevated in the middle and touching the metastethium: venter marked obliquely behind the spiracula with a small yellow-castaneous spot: last tibiæ in ♂, curved, in ♀, straight, narrowly furrowed beneath from the base, hardly beyond the middle: last tarsi with the first joint at the apex and second at the base yellow-castaneous: wings obscurely subviolaceous-fuscons: dorsum of abdomen opaque (*Stål*). Long, 36-46 mill.

Reported from Java, India, Sibsagar (Assam).

### 371. *EUSTHENES SCUTELLARIS*, Herrich Schäffer.

*Tesseraatoma scutellaris*, Herr. Schaff., Wanz. Ins. iv, p. 81, t. 133, f. 410 (1839): Walker, Cat. Het., iii, p. 463 (1868).

*Eusthenes minor*, Voll., Faun. Ent. l'Arch Indo Néer., iii, p. 29 (1868).

*Eusthenes scutellaris*, Stål, En. Hom., i, p. 71, 231 (1870); Distant, A. M. N. H. (5 s.) iii, p. 45 (1879).

Dark castaneous-brown: head, scutellum, abdomen, antennæ and feet darker, apex of the fourth joint of the antennæ ferruginous: above sparingly punctured: pronotum and scutellum transversely rugose; apex of scutellum narrow, produced: last femora incrassate, having near the base inwards, a very long, somewhat curved tooth and before the apex two teeth: last tibiæ stout, arcuate (*Herr. Schaff.*), ♂, beneath usually of a very obscure brown with a violet tinge, and the ♀ of a brown-red. *Stål* remarks that this species differs from *E. robustus*, *Serv.*, in its smaller

size, pronotum not so broad, anterior lateral margins somewhat straight, or very slightly rounded, apex of scutellum narrower, longer, behind the middle, gradually narrowed, angulated at the apex, mesostethial ridge posteriorly broader and more tumid, metastethium pallescent, apparently shorter and broader, abdomen especially behind the middle narrower, posterior angles of sixth segment more acute and produced to a greater distance, anal lobes longer and narrower, last pair of feet a little shorter, last pair of femora not reaching sixth ventral segment, first joint of last tarsi shorter, its apex, also base of second joint concolorous, which, however, varies much: wings paler, palely sub-fuscaous ochraceous; dorsum of abdomen subviolaceous-shining. Long, 25-27 mill.

Reported from Java, Sumatra, India, Khasiya Hills (Assam, mihi).

### 372. *EUSTHENES HERCULES*, Stål.

*Eusthenes Hercules*, Stål, En. Hem. i, p. 231 (1870).

Above rufescent piceous; beneath piceous-flavescent; a narrow median band on the venter, fuscous, spiracula with a pale cincture; scutellum and feet fuscous-piceous, last pair of feet more obscure; tarsi flavescent-castaneous: dorsum of abdomen obscurely somewhat ferruginous, obsolete punctulate: connexivum subviolaceous-black, basal spot on segments yellow-castaneous: apex of scutellum castaneous.

♂. Anal segment amplified hindwards, broadly somewhat truncated at the apex, somewhat sinuated in the middle, posterior angles rounded at the extremity of the apex: apical angles of the sixth segment of the abdomen not so produced, obtuse at the apex itself: metastethium equally narrowed forwards and hindwards from the middle, equally broad at the base and apex, posteriorly slightly inflexed: second ventral segment not elevated in the middle, not touching the metastethium, punctuation as in the other species of the genus; stature and form of pronotum like *E. robustus*, Serv.; differs in having the pronotum not broader than the hemelytra, the mesostethial ridge posteriorly very slightly elevated and furrowed almost to the base, the colour of metastethium, of the lower side of the body and tarsi; also the first joint of the last pair of tarsi longer: last tibiae in ♂, stout, hardly curved towards the base, beneath narrowly convex, almost third basal part broadly depressed, gradually narrowed (*Stål*). Long, 39; breadth at base of hem. 20 mill.

Reported from Silhat, Naga Hills (Assam).

373. *EUSTHENES EURYTUS*, Distant.

*Eusthenes eurytus*, Dist., Trans. Ent. Soc., p. 358 (1887).

Allied to *E. hercules*, Stål, but smaller, the pronotum much less rounded at the antero-lateral margins, and the lateral angles even less produced than in that species: antennæ entirely black, except the apical joint which is very narrowly ochraceous at the apex: tarsi bright ochraceous (*Dist*). Long, 36; exp. angl. pron. 16 mill.

Reported from India.

374. *EUSTHENES CUPREUS*, Westwood.

*Triaatoma cuprea*, Westwood, Hopo. Cat. Hem., i p. 27 (1837).

*Eusthenes cupreus*, Dallas, List Hem., i. p. 342 (1851); Walker, Cat. Het., 1, p. 467 (1868). Stal, En. Hem., 1, p. 71, 231 (1870); Distant, A. M. N. H., (5 s.) III, p. 45 (1879).

Castaneous, coppery or brassy, more or less shining; scutellum black: antennæ as long as half the body, first joint very minute, 2-3 joints equal, fourth longer, extreme tip rufescent; posterior femora (♂) long and much thickened, furnished with a long spine before the middle and with teeth towards the apex: pronotum and scutellum more or less deeply transversely furrowed: anal apparatus in ♂, formed of two lobes; in ♀, quadrilobate (*Westw*). Long, 27 mill.

Reported from Nepál, Assam, Sikkim (mihi). N. India, Ponang, Siam

Stål notes (En. Hem. i, p. 231) that in collections two species are confused, one (long, 24; breadth of hem 12 millims) known by its smaller size, a little more shining, anterior part of pronotum and the hemelytra at base olivaceous, somewhat senescent, antennæ shorter, anterior lateral margins of the pronotum not reflexed, dorsum of abdomen with a large shining brassy-green disc. The other species is larger (long, 29—35, breadth of hem. 14½—17¼ millims), less shining, pronotum anteriorly more obscure, but scarcely olivaceous or senescent, antennæ longer, extreme part of the anterior lateral margins of the pronotum very narrowly reflexed, dorsum of abdomen without a brassy-green disc. The longer of these species is *E. cupreus*, Westw., and the other is *E. theaeus*, Stål.

375. *EUSTHENES THEAEUS*, Stål.

*Eusthenes theaeus*, Stål, En. Hem., i, p. 231 (1870).

Characters as noted above under *E. cupreus*, Westw.

376. *EUSTHENES POLYPHEMUS*, Stål.

*Eusthenes polyphemus*, Stål, Trans. Ent. Soc., (3 s.) i, p. 598 (1868); En. Hem., i, p. 72, 232 (1870); Walker, Cat. Het., iii, p. 468 (1868).

♂, ♀. Above more or less obscurely senescent-castaneous; beneath with feet, apex of scutellum, a great part of the first joint of the antennæ and small dorsal marginal spots on the abdomen, yellow-castaneous; last pair of femora somewhat fuscous-castaneous. In the ♀, the metastothrum is posteriorly much broader than in the ♂, in which the form of the metastethium is very like that of *E. hercules*, Stål, and also the form of the second ventral and anal segments, but differs in having the mesostethial ridge more elevated and there without a furrow, the last pair of tibiæ not so stout, and the lower flattened part longer, reaching the middle of the tibiæ. The last tibiæ, in the ♂, are very slightly curved. Differs from *E. robustus*, Serv., in having the anterior lateral margins of the pronotum, not, unless posteriorly, slightly rounded, lateral angles somewhat more prominulous, the very large spine on last pair of femora and the last pair of tibiæ more curved: the last tibiæ, in ♂, are very slightly curved. Long, 33; broad, 17 mill.

Reported from the Dekhan, N. India.

377. *EUSTHENES SEVUS*, Stål.

*Eusthenes sevus*, Stål, Trans. Ent. Soc., (3 s.) i, p. 597 (1868); Walker, Cat. Het., iii, p. 468 (1868); Stål, En. Hem., i, p. 72, 232 (1870).

♂, ♀. Olivaceous-black, slightly turning into ferruginous: beneath with the base of the apical joint of the antennæ and the apex of the scutellum, yellow testaceous, here and there purpurascent and senescent. Smaller than *E. robustus*, Serv., and longer than *E. cupreus*, Westw., differs in having the antennæ a little stouter, also in the colour of the apical joint of the antennæ and of the apex of the scutellum, especially, in having the elevated part of the metastethium narrower posteriorly, and the large spine of the last pair of femora in the ♂ placed nearer to the base; the other spines on the last femora are fewer and smaller than in *E. robustus*: apical angles of sixth abdominal segment, in ♂, somewhat straight, hardly acute: anal segment in ♂ posteriorly: broadly and obtusely sinuated, posterior angles obtusely rounded (Stål.) Long, 27-30; broad, 13 mill.

Reported from N. China: Dekhan, Sikkim (mihi).

378. *EUSTHENES ANTENNATUS*, Distant.

*Eusthenes antennatus*, Distant, Trans. Ent. Soc., p. 357 (1897).

Head, pronotum and corium purplish brown. legs ochraceous;

scutellum very dark olivaceous with the apex castaneous: membrane shining brassy brown: basal and apical joints of the antennæ ochraceous, the last with the apex blackish, 2—3 joints blackish, base of second joint very narrowly ochraceous: apical joint somewhat longest, 2 very slightly longer than 3: body beneath brownish-ochraceous, or, in some, castaneous: legs castaneous, tarsi very slightly pale: pronotum finely, transversely striate; scutellum more coarsely striate; corium thickly and finely punctate: posterior femora with a long spine and a double row of short spines on apical half of the under surface, of which the two last are the longest. The elongate form of the body and the colour of the antennæ distinguish this species which is variable: connexivum generally purplish brown, with a more or less distinct ochraceous spot at the base of the segments (*Dist*) Long, 35-36; exp. angl. pron., 12 mill.

Reported from Khasiya Hills (Assam); Nepal.

#### Genus EUROSTUS, Dallas.

List Hem. i, p. 342 (1851); Walker, Cat. Het., iii, p. 468 (1868): Stål, Hem. Afric. i, p. 225 (1864); En. Hem., i, p. 72 (1876).

Head longer than broad, narrowed in front, with the apex slightly emarginate: antennæ 4-jointed, second joint longer than the third, fourth about equal to the second: rostrum 4-jointed, scarcely reaching the middle of the mesostethium, second joint longest, 3-4 nearly equal, shorter than the first; pronotum with the lateral angles unarmed, posterior margin not produced: scutellum, short, not reaching the middle of the abdomen; the apex small and rounded, somewhat spoon-shaped: abdomen unarmed at the base: sternum without a ridge: legs stout; the four anterior femora with two spines beneath close to the apex, last pair much incrassated (♂), with a very long acute spine near the base, two shorter ones near the apex, and a double row of minute spines, or acute tubercles, running along the under surface (*Dallas*).

#### 379. EUROSTUS VALIDUS, Dallas.

*Eurostus validus*, Dallas, List Hem. i, p. 343, t. 11, f. 2 (1851); Walker, Cat. Het. iii, p. 468 (1868): Stål, En. Hem. i, p. 72 (1870).

♂. Elongate-ovate, deep chestnut, punctured: head finely rugose: pronotum minutely punctured, faintly transversely rugose, with the anterior and lateral margins, black: scutellum coarsely rugose, with the disc finely, the margins coarsely, punctured; with the lateral margins and the tip blackish: corium rather paler than the rest of the surface, very thickly and minutely punctured: membrane brownish, semitrans-

parent: margins of abdomen black: the abdomen beneath, smooth and shining, impunctate, tinted with violet; stigmata yellowish: pectus violet-black, strongly wrinkled; prostethium castaneous with a violet-black, wrinkled patch; sternum pale: legs pitchy castaneous, slightly shining, with numerous minute tubercles; tarsi paler: rostrum castaneous, with the tip black: antennæ black; apical joint bright orange, with the base black (*Dallas*). Long, 30-31 mill.

Reported from China, India (?).

### 380. *EUROSTUS GROSSIPES*, Dallas.

*Eurostus grossipes*, Dallas, List Hem., i, p. 343 (1851). Walker, Cat. Het., iii, p. 468 (1868). Stål, En. Hem., i, p. 72 (1870). Distant, A. M. N. H. (5 s.) iii, p. 45 (1879).

Head, pronotum and scutellum opaque, pitchy, with a greenish tinge: pronotum faintly wrinkled transversely, with a leathery appearance; lateral margins narrowly edged with brown: scutellum coarsely wrinkled, with the whole surface also finely wrinkled and sparingly punctured, the apex much hollowed, impunctate, dull orange: coriaceous portion of the hemelytra deep pitchy brown, opaque; membrane, pale brown, opaque: margins of the abdomen of the same colour as the pronotum with a dull orange band at the base of each segment: abdomen beneath dull violet, opaque, with the lateral margins and the obtuse median ridge, pale fulvous brown: pectus dull violet, wrinkled, with the margins and the sternum brown: legs pale fulvous brown; posterior femora very stout: rostrum brown: antennæ with the basal joint brown, second black, extreme tip of fourth joint slightly ferruginous (*Dallas*). Long, 35-36 mill.

Reported from Assam, Sikkim (mihi).

### Genus *MATTIPHUS*, Am. & Serv.

Hist. Nat. Ins. Hém., p. 168 (1843). Dallas, List Hem., i, p. 344 (1851); Walker, Cat. Het., iii, p. 468 (1868). Stål, Hem. Afric. i, p. 225 (1864); En. Hem., i, p. 72 (1870).

Pronotum dilated laterally, transversely quadrate, anterior angles long, rather pointed, anterior margins slightly roundly emarginate: sternum with a rather narrow ridge, very distinct, situate between the intermediate and last pair of feet: abdomen not or scarcely extending beyond the hemelytra on each side: the other characters as in *Pycnum* (*Am. & Serv.*).

**MATTIPHUS LATICOLLIS**, Westwood.

*Eusthenes laticollis*, Westw., Hope, Cat. Hem., p. 27 (1837). Java.

*Mattiphus carrenos*, Am. & Serv., Hist. Nat. Ins. Hém., p. 168 (1848). India.

*Mattiphus laticollis*, Dallas, List Hem., i, p. 344 (1851); Walker, Cat. Het., iii, p. 468 (1868); Stål, En. Hem., i, p. 72 (1870). Malacca.

Castaneous, shining: pronotum transverse, quadrate: scutellum castaneous-black, extreme tip whitish: antennæ blackish, apices of joints, white: sides of abdomen, black, immaculate: body beneath, with feet, luteous: abdomen shining brassy, sides with a row of transverse black lines (*Westw.*). Long, 27 millims

Reported from Java, India, Malacca.

**381. MATTIPHUS OBLONGUS**, Dallas.

*Mattiphus oblongus*, Dallas, List Hem., i, p. 344 (1851) Walker, Cat. Het., iii, p. 468 (1868) Stål, En. Hem., i, p. 75 (1870)

♂, ♀. Above brilliant brassy green, generally becoming dull pitchy brown after death: pronotum transverse, quadrate, with the anterior angles rather less than right angles, the anterior margin nearly straight, with a small median emargination for the reception of the head, the lateral margins also nearly straight, the posterior margin gently rounded; the surface of the pronotum is faintly wrinkled transversely and minutely punctured: scutellum transversely wrinkled, and rather thickly and finely punctured: margins of the abdomen projecting beyond the hemelytra on each side, especially at the apex; the posterior angles of the apical segment very prominent, acute, making the apex of the abdomen apparently truncated, and giving an oblong form to the whole body: body beneath golden yellow: legs pale fulvous brown: antennæ darker, with the tip of the third and base of the fourth joints yellow or orange; the remainder of the fourth joint black (*Dallas*). Long, ♂ 25; ♀, 27 mill.

Reported from N. India. The Indian Museum has specimens from Assam.

**382. MATTIPHUS ERUGINOSUS**, Stål.

*Mattiphus eruginosus*, Stål, Trans. Ent. Soc., (3 s.) i, p. 600 (1863); En. Hem., i, p. 73 (1870); Walker, Cat. Het., iii, p. 469 (1868).

♂. Oval, above brassy-green, punctulate; pronotum transversely slightly rugose, behind the middle and the hemelytra inwards, turning into ferruginous: beneath with feet, the extremity of the apex of the scutellum, apex of third and base of fourth joint of the antennæ, also small marginal spots on the abdomen, testaceous-flavescent: pectus and

venter shining golden purplish: femora unarmed. Stature of *Pycnum rubens*, Fabr., nearest to *M. reflexus*, Dallas, from the Philippines, distinct in having the lateral margins of the pronotum straight from the apex beyond the middle, thence obtusely roundly angulate, antennæ stouter, and marking otherwise (*Stål*). Long, 21; broad, 11 mill.

Reported from Ceylon.

### Genus ASIARCHA, Stål.

En. Hem., i, p. 73 (1870).

Body oval: head somewhat short, equally long and broad between the eyes; jugs contiguous, rounded at the apex, lateral margins straight: ocelli scarcely twice as far from the eyes as from each other: rostrum reaching the intermediate coxæ: second joint of the antennæ longer than the third: sides of pronotum dilated: abdomen gradually slightly narrowed hindwards, apical angles of segments acute, a little prominulous, angles of sixth segment altogether prominulous hindwards, in ♂, acute: prostethium furrowed: mesostethium with a longitudinal furrowed ridge or wrinkle: metastethium elevated, anteriorly and posteriorly, narrowed, higher than the base of the mesostethium: first ventral segment elevated in the middle in a tubercle, touching the base of the metastethium: feet moderate, femora beneath with two rows of very minute teeth, last pair armed inwards near the apex with a largish spine: last tibia somewhat straight, as long as the femora. Near *Mattiphus*, Am. & Serv., differs in having the head shorter, more obtuse, the structure of the sterna, the angles of the last abdominal segment in ♂ acute, produced, and the first ventral segment elevated in the middle (*Stål*).

### 383. ASIARCHA NIGRIDORSIS, Stål.

*Mattiphus nigradorsis*, Stål, Trans. Ent. Soc., (3 s) i, p. 600 (1863). Walker, Cat. Het., iii, p. 469 (1868)

*Asiarcha nigradorsis*, Stål, En. Hem., i, p. 73 (1870).

♂, ♀. Above black, obsoletely verging into ferruginous, beneath with antennæ and feet testaceous-flavescent; extreme margin of venter black, the fourth joint of antennæ, black, flavescent at the base, the third joint (except apex) infusate: membrano greenish æneous. Allied to *M. oblongus*, Dallas, but differs in being larger, above black: pronotum more amplified forwards, lateral angles more produced, smaller, part of anterior margin reflexed, posterior angles of sixth abdominal segment produced more acutely and a little farther. Head obtuse, about as long as the intraocular breadth; pronotum gradually distinctly amplified for-



wards, lateral angles distinctly produced forwards: posterior angles of sixth abdominal segment acute (*Stål*). Long, 29; broad, 15 mill.

Reported from India, Panjab.

#### Genus *CARPONA*, Dohrn.

Stettin, Ent. Zeit., xxiv, p. 851 (1863); Stål, En. Hem., i, p. 74 (1870). Includes *Virbius*, Stål, Hem. Africa, i, p. 225 (1864).

Form of the pronotum as in *Dalcantha dilatata* Am. & Serv., the lateral margins are produced in the form of an equilateral triangle with the apex on a level with the eyes: form of the abdomen is very like that of *Pygoplatus*, Dallas, and entirely different from *Dalcantha*, Am. & Serv., moreover the metastethium is unarmed, which distinguishes it from *Pygoplatus*; likewise the abdomen is not prolonged in a thorn or spine; the last femora are a little thicker than the others and the apex of each femur has two teeth: first joint of the antennæ not reaching beyond the level of the head (*Dohrn*).

#### 384. *CARPONA ANGULATA*, Stål.

*Pycnum angulatum*, Stål, Trans. Ent. Soc., (3 s.) i, p. 601 (1863); Walker, Cat. Het., iii, p. 471 (1868).

*Virbius angulatus*, Stål, Berlin Ent. Zeit., p. 158 (1868).

*Pycnum smaragdiferum*, Walker, l. c., p. 472 (1868).

*Carpona angulata*, Stål, En. Hem., i, p. 74 (1870).

♀. Submœneous-black, beneath fuscous-ferruginous, tinted brassy-green: small marginal spots on abdomen yellow-testaceous: sides of pronotum angulated, amplified, angles turned forwards, anterior margin of the lateral dilated part sinuate, lateral margins subparallel: femora beneath with two spines near the apex: last tibiæ distinctly curved (*Stål*). Long, 32; broad, 16  $\frac{1}{2}$  mill.

Reported from Siam.

#### 385. *CARPONA FUNESTA*, Dohrn.

*Carpona funesta*, Dohrn, Stettin Ent. Zeit., xxiv, p. 851 (1863); Walker, Cat. Het., iii, p. 474 (1868); Stål, En. Hem., i, p. 74 (1870).

Obscurely black-piceous, opaque, very finely and densely punctured: head strongly rugose, jugæ somewhat exarculate, tylus shorter; eyes and ocelli brownish, the latter of a lighter colour: first joint of the antennæ extending somewhat beyond the head, second joint about four times as long as the first: lateral margins of head, margins of gular plates, and base of second joint of rostrum light brown-yellow: anterior margin of pronotum is semilunately emarginate, and ends on each side in a yellow

protuberance; here also the somewhat exarculate fore border separates from the lateral borders in a rather equilateral produced triangle which approaches the other side of the lateral margins in a rounded pointed angle of about  $75^{\circ}$ : humeral angles rounded and with the posterior half of the pronotum and the strongly rugose scutellum shining, the anterior half of the pronotum and the corium are dull: membrane dark brown with a metallic lustre: beneath dull piceous-brown, the margins of each part of the pectus, two spots in the middle of the mesostethium, the margin of the corium and a spot on the base of the margin of each abdominal segment light yellow brown: feet dark piceous-brown with prominent beaded edges. Very like *C. angulata*, Stål, and hardly specifically different: it is however, distinguished by the pronotum being more opaque, dilated part more finely and more densely rugulose, venter finely and densely punctulate, apical angles of pronotum ochraceous at the apex, prominulous in a tooth to the eyes, anterior margin of lateral dilated part of pronotum straight, at anterior angles only not entirely gradually sinuate, juga less narrowed towards the apex, there more rounded outwards. Long, 34 mill.

Reported from Cambodia.

### 386. *CARPONA AMPLICOLLIS*, Stål.

*Pycnum ampicolle*, Stål, Trans. Ent. Soc., (3 s) i, p. 600 (1863); Walker, Cat. Het., iii, p. 470 (1868).

*Carpona ampicollis*, Stål, En. Hem., i, p. 74 (1870).

♀. Black, minutely rugulose, punctulate, beneath turning into ferruginous; pronotum transverse, lateral angles produced forwards, stature almost that of *M. oblongus*, Dallas, pronotum proportionately broader, more dilated forwards and the lateral angles more produced: 2 and 4 joints of antennæ of equal length, third somewhat longer: pronotum gradually somewhat amplified from the base forwards, then abruptly forming on both sides an angle somewhat produced forwards: scutellum more distinctly punctured than the pronotum: beneath very densely, finely rugulose punctulate: femora beneath near the apex armed with two spines, the interior spine on the last femora robust: last tibiæ slightly curved behind the middle (Stål). Long, 32; broad, 18 mill.

Reported from N. India.

### 387. *CARPONA AMYOTI*, Vollenhoven.

*Pycnum amyoti*, Voll., Tijdsch. voor Ent., (2 s) i, p. 219, t. ii, f. 7 (1866); Faune Ent. l'Aroh. Indo. Néer., iii, p. 34, t. 3, f. 8 (1868); Walker, Cat. Het., iii, p. 471 (1868).

*Carpona amyoti*, Stål, En. Hem. i, p. 74 (1870).

Of a deep cherry-brown, a little lighter beneath: antennæ black, tip

yellow: eyes light brown, ocelli yellow: pronotum dilated, disc finely transversely rugose and irregularly punctured: scutellum distinctly rugose, its apex lighter: hemelytra very finely punctulate, the margin obscure near the base: membrane transparent brown: rostrum, marks on the pectus, the coxæ, and the reflexed margin of the hemelytra, yellowish: some small triangular white patches on the lateral margins of the abdominal segments; the sixth segment is acuminate in both sexes, the 4-6 segments a little dilated in the ♀: feet stout, with long spines on the femora (*Voll.*). Scarcely differs from the preceding, compared with Vollenhoven's figure it differs in having the angles of the dilated part of the pronotum produced much more forwards than in *O. angulata*, Stål. Long, 32; broad, 19 mill.

Reported from India (P), Sumatra (P).

#### Genus PYCANUM, Am. & Serv.

Hist. Nat. Ins. II (m.), p. 171 (1843). Dallas, List Hem., i, p. 345 (1851); Walker, Cat. Hem., iii, p. 470 (1868). Stål, Hem. Afric., i, p. 225 (1864); En. Hem., i, p. 75 (1864).

Head rather pointed, anterior margin slightly emarginate: antennæ long, joints rather robust, the first scarcely extending beyond the anterior margin of the head, the rest almost canaliculate, the second a little larger than the third which is as long as the fourth: rostrum reaching the middle of the space lying between the insertion of the first and that of the second pair of feet: pronotum semilunate, rather regularly rounded in front, posterior border almost straight and not produced over the scutellum, lateral margins flat and a little reflexed: no sternal ridge: scutellum rather broad at the base, but short, not reaching the middle of the abdomen; its apex very small, extended a little in form of a long square and its tip spoon-shaped: abdomen oval, margins flattened and almost foliaceous, extending on each side a little beyond the hemelytra: venter tumid: base not elevated: feet moderate; femora beneath with two more or less prominent spines at the apex (*Am. & Serv.*).

#### 388. PYCANUM RUBENS, Fabricius.

*Cymus rubens*, Fabr., Ent. Syst., iv, p. 107 (1794) Stoll, *Funaises*, p. 21, t. 4, f. 25, 29 (1788).

*Cymus amethystinus*, Weber, Obs. Ent., p. 115 (1801).

*Edessa amethystina*, Fabr., Syst. Rhynch., p. 150 (1803).

*Edessa rubens*, Fabr., Syst. Rhynch., p. 151 (1803).

*Tessaratoma alternata*, St. Farg. & Serv., En. Méth., x, p. 591 (1825).

*Aspongopus amethystinus*, Burm., Handb. Ent., ii (1), p. 351 (1835); Herr. Schaff., Wenz. Ins., iv, p. 85, t. 185, f. 417 (1839); Blanchard, Hist. Ins., p. 148 (1840).

*Pycnanum amethystinum*, Am. & Serv., Hist. Nat. Ins. Hém., p. 172 (1848); Dallas, List Hem. i, p. 345 (1851); Walker, Cat. Het., iii, p. 470 (1868).

*Didor amethystinus*, Herr. Schaff., Wanz. Ins., vii, p. 76 (1844).

*Pycnanum rubens*, Vollenhoven, Faune Ent. l'Arch. Indo-Néer., iii, p. 32 (1868); Stål, Hem. Fabr. i, p. 40 (1868); En. Hem. i, p. 75 (1870); Distant, A. M. N. H., (6 s.) iii, p. 45, 52 (1879).

Antennæ pilose, black, last joint a little rufescent at the apex: head greenish, shining, blackish at the apex: pronotum ruddy, anterior and lateral margins virescent: scutellum greenish, shining, with a flavescent spot on the apex: hemelytra ruddy, spotless: wings obscure: abdomen reddish, last segment greenish and the margin spotted yellow: feet black (*O. rubens*, Fabr.). Head with the margin a little reflexed; juga wrinkled at their base, brown-violaceous above: antennæ black, briefly pilose; apex of the last joint slightly brownish: eyes brown, ocelli lighter: pronotum of a semicircular form, not dilated, red-brown, transversely rugose, especially posteriorly, its lateral margins reflexed: scutellum of the same colour, transversely rugose, apex yellowish: hemelytra concolorous, very finely punctulate, interior and exterior margins transversely rugose: membrane nacreous brown: the portion of the abdomen extending beyond the hemelytra has alternate yellow and black bands: body beneath ochraceous, mottled with light brown and a little violet: feet brownish, more obscure above. Long, 12-16 mill.

Var. *a*. Light yellowish brown above: borders of head and the antennæ violet grey: venter a little more violet than the type. Sumatra.

*b*. Rather obscure brown violet: head and anterior margin of pronotum with a dull green reflection: beneath mottled with light brown, violet and bronzy green: margin of abdomen with square alternate yellow and violet spots. Sumatra.

*c*. Obscure brown violet: head, anterior margin of pronotum and the scutellum of a dull green: below of a beautiful violet, with ochraceous patches: feet black. Banca, Biliton: a variety of *P. amethystinus* Fabr. and found in Assam (mihi).

*d*. Blackish violet: posterior margin of pronotum and posterior half of hemelytra, bronzed green: pectus brown violet; venter very deep violet, spotless; feet brown. Sumatra.

*e*. Head, pronotum and scutellum of a brilliant green: hemelytra cherry-red: entire body below golden green with brownish-yellow patches: margin of abdomen yellow with patches of an obscure brown: femora red: tibiae deep brown. Malacca (*Voll.*).

In Assam and Sikkim the representatives of this species are usually of an uniform ochraceous colour above.

Reported from the East. Arch., Assam, Sikkim (mihi).

389. *PHYCANUM PRETIOSUM*, Stål.

*Phycanum pretiosum*, Stål, Cefvers. K. V.-A. Förh., p. 234 (1854); l. c., p. 64, t. 1 a, f. 2 (1856); l. c., p. 645 (1870); En. Hem. i, p. 75 (1870); Walker, Cat. Het. iii, p. 471 (1868).

Pronotum, scutellum and hemelytra obscurely sanguineous, violaceous: beneath violaceous, sanguineous: anterior part of head violaceous green, rugulosely punctured; antennæ black, fulvous at the extreme apex, last joint much longer than the preceding: pronotum broadly truncate anteriorly, sinuate behind the head, sides oblique, somewhat straight, rugosely punctured, anteriorly and with two basal spots, metallic green: scutellum rugosely punctured, green at the base on both sides, luteous at the apex: hemelytra at the apex virescent, rather finely punctulate: membrane cupreous: pectus and abdomen on both sides varied green, its margin above and below luteous, spotted black: feet obscurely fuscous, castaneous, femora spinose at the apex. Long, 26; broad, 14 mill. Reported from Penang. Hardly differs from *P. rubens*, and should belong to variety (*d*); only a slight dissimilarity in the form of the pronotum and the length of the third joint of the antennæ.

390. *PHYCANUM PONDEROSUM*, Stål.

*Phycanum ponderosum*, Stål, Cefvers. K. V.-A. Förh., xi, p. 231 (1854); l. c. xiii, p. 63, t. 1 a, f. 1 (1856); Walker, Cat. Het. iii, p. 471 (1868); Stål, En. Hem., i, p. 75 (1870).

*Dalcantha Sancti Fargavi*, Voll., Tijdschr. Ent., (2 s.) i, p. 218, t. 11, f. 6 (1866).

♀ Sordid luteous above and beneath, scutellum and hemelytra luteous; rugosely punctured: head triangular, subemarginate at the apex, margined black: antennæ black, fulvous at the extreme tip: pronotum transverse, equally broad, anteriorly and posteriorly, sinuate behind the head, dilated anteriorly on both sides, rugulosely punctured, except the basal margin, very narrowly margined black: scutellum rugosely punctured, more weakly luteous at the apex: hemelytra densely punctured; membrane sordid hyaline; beneath with three large patches on both sides of the pectus, one on both sides on the abdomen, oblong, broad, much sinuated inwards, metallic green: abdomen above with black marginal spots: feet obscurely castaneous, femora spinose at the apex (Stål). Long, 33; broad, 18 mill. Differs from *P. rubens*, Fabr., in being larger and stouter and in the longer last joint of the antennæ; the pronotum, moreover, is rectangular, dilated anteriorly on both sides. The *D. Sancti Fargavi*, Voll., is luteous, head and sides of pronotum margined black: abdominal limb spotted fuscous, antennæ, black. Long, 28-35; broad, 20-21 mill.

Reported from Silhat, Assam, Demdim (mihi).

391. *PYCANUM JASPIDEUM*, Herrich Schaffer.

*Pycanum jaspideum*, Herr. Schaff., Wans. Ins., ix, p. 308, t. 323, f. 1009 (1852); Walker, Cat. Het., iii, p. 470 (1868); Stål, En. Hem., i, p. 75 (1870).

Aeneous-cupreous, beneath and feet obscurely testaceous: like *P. rubens*, Fabr., antennæ longer and thinner, second joint much longer than the third; first joint brown yellow, apex of third and base of fourth joint, white yellow: lateral margins of the pronotum strongly reflexed, ventricosely advanced, its surface and that of the scutellum strongly transversely rugose: feet and beneath brown-yellow without a metallic lustre: the incisures of the margin of the abdomen alone yellowish (*H. S.*). The color of the feet and marking of the antennæ in this species would place it in *Mattiphus*, but the spined femora bring it into *Pycanum*. Long, 25 mill. ♀

Reported from Assam.

392. *PYCANUM* (?) *RUBIDUM*, Walker.

*Pycanum rubidum*, Walker, Cat. Het., iii, p. 471 (1868).

Deep red: sides of head and pronotum, antennæ, legs and costa of the hemelytra, at the base, black: head thickly and very minutely punctured, obliquely striated on each side in front; eyes testaceous; rostrum tawny; second joint of antennæ a little longer than the third, fourth much longer than the second: pronotum transversely and finely striated, minutely and rather thinly punctured, sides slightly rounded, obliquely striated: scutellum less finely striated than the pronotum: pectus and underside of the abdomen metallic-green: luteous spots on each side of the abdomen, femora blackish red: hemelytra very thickly and minutely punctured, membrane lurid. Pronotum more dilated than in *P. rubens*, possibly only a variety (*Walker*). Long, 27½ mill.

Reported from Mount Ophir.

393. *PYCANUM* (?) *STABILE*, Walker.

*Pycanum stabile*, Walker, Cat. Het., iii, p. 472 (1868).

Dark dull red: sides of the head and of the pronotum, legs and costa of the hemelytra, at the base, black: head extremely minutely punctured, with an aeneous tinge: rostrum piceous: pronotum transversely and finely striated, minutely and rather thinly punctured; fore part nearly smooth; sides in front longitudinally striated, dilated and forming two rounded right angles: scutellum less finely striated than the pronotum: pectus metallic green; lobes mostly bordered with tawny: abdomen with black lateral spots, underside with two very broad me-

lallio green stripes; disc longitudinally and very finely striated: hemelytra extremely minutely and thickly punctured, partly and slightly tinged withaceous-green; membrane cinereous (*Walker*). Body long, 32-33 mill.

Reported from India: appears to be intermediate between *P. ponderosum*, Stål, and *Carpona angulata*, Stål, (Siam).

#### 394. PYCANUM (?) PALLIPES, Walker.

*Pycanum pallipes*, Walker, Cat. Het., iii, p. 473 (1868).

Blackish green, pale luteous beneath: head, pronotum and scutellum very thickly and minutely punctured: head pale luteous behind, and with an interrupted stripe of that hue: eyes pale luteous, with ferruginous disc: antennæ luteous; second joint more or less brown above; third brown, yellow towards the tip, much shorter than the second; fourth black, yellow towards the base, a little shorter than the second: pronotum with a very narrow luteous border, transversely and finely striated; fore part on each side much dilated, longitudinally striated, forming a well defined right angle: scutellum transversely rugulose: abdomen above purple; connexivum deep green, bordered with brown, and, at the tip, with pale luteous: hemelytra blackish, irregularly red about the borders; membrane emerald green: wings blackish cinereous (*Walker*). Body long, 25 mill.

Reported from N. India. Walker notes that it appears to be a link between *Pycanum* and *Dalcantha*, and is close to *D. stålui*, Voll.

#### Genus OXYLOBUS, Stål.

En. Hem., i, p. 75 (1870).

Body ovate: head small, gradually somewhat sinuately narrowed before the eyes; jugæ contiguous, rounded at the apex; ocelli twice as far from each other as from the eyes: rostrum reaching middle of mesostethium: antennæ 4-jointed, fourth joint longer than the second: sides of pronotum dilated: prostethium longitudinally sulcate: mesostethium with a depressed, continued ridge or wrinkle, furrowed through its entire length: metastethium not elevated: abdomen gradually amplified hindwards, angles of segments acute, very slightly prominulous, sixth segment very broad, apical angles acute, produced to a distance: basal segments of venter not elevated in the middle: feet moderate; tibiæ straight; last pair somewhat equal to femora in length: differs from *Pycanum* in the shape of the abdomen (*Stål*).

395. *OXYLOBUS NIGRO-MARGINATUS*, Stål.

*Pycnum nigro-marginatum*, Stål, Trans. Ent. Soc., (3 s.) i, p. 601 (1868): Walker, Cat. Het., iii, p. 470 (1868).

*Dalcantha serrillei*, Voll, Tijds. voor Ent., (2 s.) i, p. 220, t. 11, f. 9 (1866).

\* *Oxylobus nigro-marginatus*, Stål, En. Hem., i, p. 75 (1870).

♂. Pale subolivaceous flavescent, or virescent; above remotely distinctly, on the hemelytra a little more densely and more finely punctured, beneath densely and minutely rugulose punctulate: narrow lateral margins of the pronotum, costal margin of hemelytra towards the base, apex of apical angles of last segment of the abdomen, also its lateral margins, black: membrane vitreous: antennæ corulean-black towards the apex. Head somewhat longer than the intraocular breadth, obtuse at the apex: second joint of the antennæ longer than the third, shorter than the apical: pronotum as in *M. laticollis*, Westw., broadly rounded at the base, gradually somewhat narrowed from the base forwards, thence anteriorly on both sides forming abruptly a right angle, rounded at the apex: abdomen gradually somewhat amplified towards the apex, apical angles of last segment acutely, obliquely produced hindwards to a distance, diverging: first femora unarmed, posterior femora with a distinct spine on the posterior side beneath towards the apex (Stål). Long, 20; broad 10 mill.

Reported from Tringani, Malacca.

Genus *DALCANTHA*, Am & Serv.

Hist. Nat. Ins. Hém., p. 170 (1843): Dallas, List Hem., i, p. 345 (1851): Walker, Cat. Het., iii, p. 473 (1868): Stål, Hem. Afric., i, p. 225, 230 (1864); En. Hem., i, p. 76 (1870).

Head short, somewhat broad; juga longer than the tylus, anteriorly contiguous, obtuse at the apex, lateral margins posteriorly rather deeply sinuated: antenniferous tubercles not prominulous, unarmed; bucculae rather elevated, reaching the base of the head: ocelli remote from the eyes: rostrum short, first joint extending somewhat beyond the bucculae posteriorly: pronotum posteriorly broadly rounded: scutellum small, triangular, subequilateral, slightly produced at the extreme apex; frena extended almost to the apex of the scutellum: membrane at the base with many areolas, emitting longitudinal veins: prostethium anteriorly scarcely dilated, furrowed in the middle: mesostethium furnished with an obtuse, somewhat furrowed, ridge, or with two parallel ridges: metastethium not elevated: venter unarmed at the base, not elevated: feet moderate, somewhat robust, femora sometimes spinose at the apex beneath; tibiae prismatic, above furrowed: tarsi 3-jointed (Stål). Differs little from *Mattiphus* and *Pycnum* except in the shorter and broader head.



396. *DALCANTHA DILATATA*, Am. & Serville.

*Dalcantlia dilatata*, Am. & Serv., Hist. Nat. Ins. Hém. p. 171 (1843); Dallas, List Hem., i, p. 345 (1859); Walker, Cat. Het., iii, p. 473 (1868); Stål, En. Hem. i, p. 76 (1870).

♀. Head, pronotum, scutellum and hemelytra of a deep green above, thickly and finely punctured or tuberculated: pronotum edged brown on the sides, on the disc with two red elongate rings pointing towards the external margin: lateral margins and apex of the scutellum, of a reddish yellow; membrane and wings, transparent nacreous, yellow-greenish: abdomen above of a yellow-red, the lateral dilatations brown-reddish, marked with some yellowish lines: body beneath yellow, mottled with brownish: feet yellowish: antennæ black, first joint yellowish, tip of the fourth joint sulphur yellow (*Am. & Serv.*). Long, 27 mill.

Reported from India.

397. *DALCANTHA STALI*, Vollenhoven.

*Dalcantlia Stål*, Vollenhoven, Tijdschr. v. Ent. Ned. Ind., (2 Ser.) i, p. 220, t. 11, f. 8 (1866); Stål, En. Hem., i, p. 76 (1870).

*Dalcantlia regia*, Walker, Cat. Het. iii, p. 474 (1868).

Purplish or fuscous black above, testaceous or luteous beneath with margins infuscate: head, pronotum and hemelytra, extremely minutely and thickly punctured: head finely and obliquely striated on each side in front: eyes testaceous; disc piceous: antennæ black, first joint tawny, testaceous beneath; third hardly longer than second; fourth testaceous towards the tip, shorter than the second: pronotum, fore part excepted, transversely and very finely striated, the fore part dilated, very slightly angular on each side: scutellum transversely and minutely rugulose, pale yellow at the tip: abdomen widening from the base to the fourth segment where it extends much beyond the hemelytra; 5-6 segments much narrower: membrane brown; pronotum less dilated than in *D. inermipes*, from which it differs also in the femora having two spines near the tips (*Walker*). Long, 25; breadth of abd. at base, 12; in fourth segment, 18 mill.

Reported from Silhat, Sibságar (Assam).

398. *DALCANTHA INERMIPES*, Stål.

*Dalcantlia inermipes*, Stål, Trans. Ent. Soc., (3 s.) i, p. 599 (1863); Walker, Cat. Het., iii, p. 473 (1868); Stål, En. Hem., i, p. 76 (1870).

♂. Above obscurely ferruginous-æneous, beneath with feet and costal limbus of hemelytra from base almost to middle, testaceous-flavescent, sparingly varied ferruginous, median longitudinal line on

venter and antennæ (the yellow-testaceous basal joint excepted), black. Allied to *D. dilatata*, Am. & Serv., differs in having the pronotum a little shorter, lateral part more dilated and rounded, antennæ more slender and femora unarmed (Stål). Long, 20; broad, 10 mill.

Reported from the Punjab.

The following genera and species require further examination before admitting them to the Asiatic list.

#### Div. ONCOMERARIA, Stål.

Tarsi 3-jointed: apical margin of corium more or less distinctly sinuate, very rarely rounded: membrane without basal areolas, transverse basal vein emitting longitudinal veins: scutellum longer than broad, part placed far behind the frena: primary and subtended veins of wings approximate or contiguous, diverging towards the apex: hamus wanting.

#### Genus PIEZOSTERNUM, Amyot & Servillo.

Hist. Nat. Ins. Hém., p. 161 (1843); Dallas, List Hem., i, p. 398 (1851); Walker, Cat. Het., iii, p. 437 (1868); Stål, Hem. Afric., i, p. 224, 227 (1864); En. Hem., i, p. 63 (1870). Includes *Salica*, Walker, l. c. p. 469 (1868).

Body large, obovate: head small triangular; juga longer than the tylus, and anteriorly contiguous; antenniferous tubercles entirely visible from above, very close to the eyes, a little prominulous, unarmed; bucculæ continuous, much elevated, higher in front than behind; eyes rather prominulous; ocelli near the eyes: antennæ 5-jointed, shortish, rounded, first joint extending beyond the apex of the head, second longer than the third; rostrum extending beyond the first pair of coxæ, first joint extending a little beyond the bucculæ posteriorly: lateral margins of pronotum very narrowly reflexed, basal part produced hindwards and covering base of scutellum which is triangular, longer than broad, acute at apex; frena extended beyond the middle of the scutellum: apical margin of corium sinuate, exterior apical angle acute: membrane with simple longitudinal veins, emitted from the transverse basal vein, prostethium simple: metastethium much elevated, posteriorly truncate, anteriorly produced, the produced part gradually compressly narrowed forwards, extended to the first coxæ, quiescent on the mesostethium: apical angles of the abdominal segments prominulous in a tooth; second ventral segment somewhat elevated in the middle at the base and touching the truncate posterior part of the metastethium: feet moderate last pair distant; femora unarmed; tibiæ slightly furrowed above; tarsi 3-jointed (Stål). From America and Africa.

399. *Piesosternum* (?) *firmatum*, Walker, Cat. Het. iii, p. 459 (1868).

*Piesosternum cribratum*, Walker, l. c., ♀, P.

Testaceous, elongate-oval, paler beneath: head minutely punctured; rostrum extending rather beyond the first coxæ; antennæ piceous, second joint longer than the third: pronotum and scutellum ~~thinly~~ and roughly punctured: pronotum with an irregular smooth band near the fore border, sides transversely striated, lateral angles produced into horns which are as long as half the intermediate space, slightly inclined forwards and ascending, with black punctures towards the tips which are slightly acute; hind border rounded, extending over the base of the scutellum which is attenuated, acute, pale-greenish and slightly grooved near the tip: pectoral ridge lanceolate extending to the first coxæ: abdomen narrowly bordered black, hind angles of the apical segment forming two spines which extend a little beyond the eight intermediate-spines: hemelytra rather thinly and roughly punctured with a blackish-patch on the disc: membrane pale cinereous (*Walker*). Body long, 14-15 mill. *P. cribratum* is a little smaller, horns more inclined forwards and scutellum smaller.

Reported from Malacca.

400. *Piesosternum* (?) *ingenuum*, Walker, Cat. Het. iii, p. 459 (1868).

Testaceous: head minutely punctured; rostrum extending a little beyond the first coxæ, tip black; antennæ luteous, less than half the length of the body, 2-3 joints about equal in length, fourth longer than the third: pronotum and scutellum thinly and roughly punctured, minutely and transversely striated along each side; horns directly diverging, with blackish punctures, rounded at the tips, longer than their breadth at the base; hind border rounded, extending over the base of the scutellum which is acute, grooved and much attenuated towards the tip: the pectoral ridge lanceolate, extending to the first pair of coxæ, notched at the base: hind angles of the apical segment of the abdomen elongated, acute, not extending beyond the anal appendages: hemelytra very thickly and minutely punctured, with variable rosy patches: membrane pale cinereous (*Walker*). Body long, 19 mill.

Locality not given (Malacca?).

#### Genus MUSCANDA, Walker.

\* Cat. Het. iii, p. 576 (1868).

Body nearly elliptical, thickly and rather roughly punctured: head small, conical in front, a little longer than broad; jugs contiguous much beyond the tylus; eyes prominent; rostrum stout, extending to the first

coxæ; antennæ slender, a little more than half the length of the body first joint extending to the front of the head, second a little shorter than the third, fourth much longer than the third, fifth shorter than the fourth: pronotum with a slight transverse ridge between the horns which are broad, slightly tapering, truncated at the tips, slightly ascending, extending obliquely forward, about half the length of the intermediate breadth of the pronotum; a transverse callus on each side in front: scutellum a little less than half the length of the abdomen, attenuated towards the apex which is rounded: pectus without a ridge; abdomen without a ventral spine: legs rather long and slender: membrane with longitudinal veins some of which are fuscate. Distinguished from *Piezosternum*, A. & S., by the long horns of the thorax and the much less acute scutellum (*Walker*).

#### 401. MUSCANDA TESTACEA, Walker.

*Muscanda testacea*, Walker, Cat. Het. iii, p. 577 (1868).

Testaceous including eyes: abdomen thinly punctured on the disc beneath, where there are black points along each side on the hind angles of the segments: membrane cinereous (*Walker*). Body long, 21 mill.

Reported from Darjiling.

#### Genus BESSIDA, Walker.

Cat. Het. iii, p. 577 (1868).

Body elongate-oval, thickly and somewhat roughly punctured: head longer than broad, narrow and rounded in front; juga contiguous much beyond the tylus; eyes small, not prominent: rostrum extending to the first coxæ; antennæ slender, about one-third of the length of the body; first joint not extending to the front of the head, second very much longer than the third, fourth longer than the third, fifth a little longer than the fourth: pronotum with a small slight transverse ridge between the horns which are stout, acute, very slightly inclined forwards and not longer than their breadth at the base; transverse callus on each side near the fore border; sides straight, slightly serrate: scutellum attenuated, rounded at the tip, more than half the length of the abdomen which is truncated at the tip: legs moderately long and stout (*Walker*).

#### 402. BESSIDA SCUTELLARIS, Walker.

*Bessida scutellaris*, Walker, Cat. Het., iii, p. 578 (1868).

Ferruginous, ochraceous beneath: antennæ, scutellum, abdomen

and legs ochraceous membrane lurid (Walker). Body long, 124-13 mill.

Reported from Burma.

#### Subfam. DINIDORINA, Stål.

En Hem 1, p 79 (1870), Ofvers K V -A Förh (3), p 32 (1872) —*Edsanda*, pt, Dallas, Lat Hem 1, p 316 (1851) *Dinidorida*, Stål, Ofvers 1 o p 522 (1867).

a, b, as in Subfam PENTATOMINA (Jl. Pt. II, p. 192, 1887).

(c)—Scutellum never extending beyond the middle of the dorsum of the abdomen, apical part broad hemelytra and wings usually complete, rarely abbreviated membrane very large primary and subterd veins of wings distant, converging at the apex, the space between not amplified there.

#### Genus CICLOPETA, Amyot & Serville

Hist Nat Ins Hem p 172 (1843), Dallas, Lat Hem 1, p 346 (1851), Walker, Cat Hct, iii, p 477 (1868), Stål, En Hem 1, p 80 (1870) —Includes *Dinidor*, Stål, (nec Latr.), Hem Afric 1, p 81, 211 (1864)

Head rather broad, but small, almost straightly truncated and slightly emarginate in front, juga longer than the tylus, eyes small, prominent, ocelli very distinct antennae rather long, 4-jointed, rather flattened, first joint short, though extending a little beyond the anterior margin of the head, second longer than the third which is a little shorter than the fourth rostrum reaching the insertion of the middle pair of feet pronotum almost semicircular anteriorly, the posterior margin slightly rounded scutellum scarcely reaching the middle of the abdomen, its apex broad and lunately rounded membrane with irregular areolas formed of transverse and longitudinal veins, not extending beyond the apex of the abdomen the abdomen broad, rounded posteriorly, margins flat and extending on each side beyond the hemelytra, feet moderate, rather robust femora with some spines beneath towards the apex (Am. & Serv.).

#### 403. CICLOPETA OBSCURA, St Farg & Serville.

*Tessarotoma obscura*, St Farg & Serv. Enc Meth, x, p 592 (1826) Java.

*Aspongopus alternans*, Westwood, Hope, Cat Hem 1, p 26 (1837)

*Aspongopus depressicornis*, Herr Schaff, Wanz Ins, iv, p 86, t 135, f 418 (1839)

*Dinidor depressicornis*, Herr Schaff, 1 c, vii, p 76 (1844)

*Cyclopelta obscura*, Am & Serv Hist Nat Ins Hem, p 173 (1843), Dallas, Lat Hem 1, p 347 (1851), Walker, Cat Hct iii, p 479 (1868), Vollenhoven, Faune. Ent l'Arch. Indo-Néer, iii, p 37 (1868), Stål, En Hem 1, p. 80 (1870); Ofvers. K V -A. Förh, p. 645 (1870), Distant, J A S B, xlviii (2), p 37 (1879). Lethierry, An Mus Gen, xviii, p 649 (1883)

♀. Body entirely dull brown mingled with shades of reddish ;

antennæ black: abdomen scarcely denticulate on the lateral margins, upper border black with red patches, lower, red with black patches: femora with two small spines placed side by side near the apex and others along them (*Serv.*). *A. depressicornis*, Herr. Schöff., is described as:—Fuscous, ovate; above very flat, coriaceous, coarse, dark red-brown, dull; fore-border of pronotum and both the humeral protuberances smoother, redder: antennæ 4-jointed, 2-3 joints depressly dilated: spots at base and apex of scutellum and on the connexivum, orange: venter convex, smoother, sordid orange varied brown: feet castaneous.

This species varies much in colour: sometimes blackish, sometimes obscurely ferruginous, beneath paler, sometimes ferruginous-flavescent; connexivum and ventral limbus marked with ferruginous or yellow-ferruginous spots: basal spot on the scutellum distinct [sometimes absent]. Long, 14-15 mill.

Reported from Assam, Sikkim (mihi), Calcutta, Madras: China, Philippines, Malacca, Java, Borneo.

#### 404. CYCLOPelta TRIMACULATA, Vollenhoven.

*Cyclopelta trimaculata*, Voll., Faune Ent. l'Arch. Ind. Néerl, iii, p. 87, t. 4, f. 4 (1868); Stål, En. Hem., i, p. 80 (1870).

Black-purplish: a small line or oblong spot on the side of the pronotum, triangular spot at base of scutellum united by a median line with a spot on the apex and two submarginal streaks on venter, yellow: rostrum, feet and border of connexivum, red (*Voll.*). Probably only a local variety. Long, 13-16 mill.

Reported from Malacca, Borneo.

#### 405. CYCLOPelta TARTAREA, Stål.

*Cyclopelta tartarea*, Stål, Ofvers. K. V.-A. Förh., p. 234 (1854); l. c. p. 64 (1856); Walker, Cat. Het., iii, p. 480 (1868); Stål, En. Hem. i, p. 80 (1870); Distant, A. M. N. H. (5 s.) iii, p. 45 (1879).

♂. Entirely blackish or subcupreous blackish above, coriaceous, punctured, transversely rugose: sometimes a minute sanguineous spot at the base of the scutellum: membrane fuscous ochraceous: beneath black, somewhat shining seruginose. Differs from *C. obscura*, only in having the connexivum concolorous, neither broadly red, nor spotted black, and in the feet being more obscure. Long, 15; broad, 9 mill. Reported from Himálaya, Bombay, Ceylon, very common in Sikkim (mihi). Long, 10-11 mill. I have an entirely black small species from Visagapatam and Dehra Dun. On the whole, the links between these three species are rather fairly established, and the two latter may be

considered local varieties. The uniform blackish variety being more common in India and those with yellow spots on pronotum, scutellum and connexivum being more common in Burma and southwards.

### Genus ASPONGOPUS, Laporte.

Ess. Hém., p. 58 (1832); pt. Am. & Serv., Hist. Nat. Ins. Hém., p. 173 (1843); Herr. Schaff., Wanz. Ins. vii, p. 77 (1844); Dallas, List Hem. i, p. 343 (1851); Walker, Cat. Het., iii, p. 480 (1868); Stål, Hem. Afric. i, p. 81, 212 (1864); En. Hem. i, p. 81 (1870). Includes, *Spongopodium*, Spinola, Ess. Hém., p. 305 (1837):—*Amacosis*, Spin., Gen. Ins. Artr. p. 118 (1852):—*Peltanopus*, Signoret, A. S. E. F. (3 s.), viii, p. 396 (1861).

Body oval or ovate: head small, subfoliaceous, jugæ sometimes a little longer than the tylus; bucculæ much elevated, foliaceous, sub-semicircular: rostrum extended almost to the intermediate coxæ, first joint extending beyond the bucculæ: antennæ 5-jointed: lateral angles of pronotum not prominent, obtuse: apical part of scutellum, broad: frena extended to or a little beyond the middle of the scutellum: veins of membrane more or less anastomosed: venter unarmed at the base; feet robust, femora often spinulose (Stål).

Stål distributes the species of this genus amongst the subgenera *Colpoproctus* and *Aspongopus*. The first is found in Africa, the second in India, and is distinguished by having the head subequilateral or scarcely transverse, the lateral margins straight or slightly sinuated, the eyes not stylated: the anal segment, in ♂, is entire at the apex, rounded, and is rarely furnished with an obsolete sinus in the middle.

### 406. ASPONGOPUS BRUNNEUS, Thunberg.

*Cimex brunneus*, Thunberg, Nov. Ins. Spec., ii, p. 45 (1783); Gmelin, ed. Syst. Nat., i, (4), p. 2158 (1778).

*A. (Aspongopus) brunneus*, Stål, En. Hem. i. p. 82 (1870); Distant, A. M. N. H. (5 s.), iii, p. 45, 52 (1879).

Above brunneous, beneath fuscous, antennæ pilose (Thunb.): closely allied to and frequently confounded with *A. obscurus*, Fabr., it is thus differentiated by Distant (l. c.).

Abdomen above red.

Third joint of the antennæ, a little longer than the second, *brunneus* Thunb.

Abdomen above black.

Second and third joints of the antennæ equal. *obscurus*, Fabr. Long, 16-17; broad, 10 mill.

Reported from India, Assam.

407. *ASPONGOPUS* *OBSCURUS*, Fabricius.

*Cimex obscurus*, Fabr., Ent. Syst., iv. p. 107 (1794).

*Edessa obscura*, Fabr., Syst. Rhyng. p. 151 (1808); Wolff, Ic. Cim., p. 177, f. 171 (1811).

*Aspongopus obscurus*, Burm., Handb. Ent., ii (i), p. 352 (1835); Herr. Schaff., Wanz. Ins., vii. p. 80 (1844); Dallas, List Hem., i. p. 349 (1851); Walker, Cat. Het., iii, p. 482 (1868); Vollen., Faune Ent. l'Arch. Inds. Néerl., iii, p. 38 (1868); Stål, Hem. Fabr., i, p. 38 (1868).

*A. (Aspongopus) obscurus*, Stål, En. Hem. i, p. 82 (1870).

Body, wings and feet, fuscous: pronotum, hemelytra and scutellum obscurely olivaceous: head and antennæ (except the yellow last joint) black: anterior margin of pronotum fuscous: scutellum more obscure at the base: margins of abdomen obsoletely spotted yellow (*Fabr.*).

♀. Yellow-castaneous, shining somewhat cupreous, densely punctured: antennæ black, last joint yellow-testaceous: margins of pronotum concolorous: upper and lower marginal spots on the abdomen, castaneous-flavescent: dorsum of abdomen testaceous: wings sordid yellow, violaceous-fuscous at the apex (*Stål*). Long, 17; broad,  $9\frac{1}{2}$  mill.

Reported from Australia, Celobes, Aru, Bouru, Java, India, Ceylon, N. Bengal, Silhat, Pondicherry: Assam (mihi), Sikkim (mihi), Calcutta.

408. *ASPONGOPUS* *JANUS*, Fabricius.

*Cimex Janus*, Fabr., Syst. Ent., p. 714 (1775); Spoc. Ins., ii, p. 357 (1781); Mant. Ins., ii, p. 295 (1787); Gmolin, ed., Syst. Nat., i (4), p. 2152 (1788); Fabr., Ent. Syst., iv, p. 107 (1794); Wolff, Ic. Cim., i, p. 13, t. 2, f. 13 (1800); Stoll, Punnaises, p. 30, t. 6, f. 41 (1788).

*Cimex afer*, Drury, Ill. Nat. Hist., iii, p. 66, t. 46, f. 7 (1782).

*Cimex surinamensis*, Gmolin, ed. Syst. Nat., i (4), p. 2134 (1788).

*Edessa Janus*, Fabricius, Syst. Rhyng., p. 151 (1808).

*Pentatoma Janus*, St. Farg. & Serville, Enc. Méth., x, p. 56 (1825).

*Aspongopus vicinus*, Westwood, Hope, Cat. Hem., i, p. 25 (1837).

*Aspongopus Janus*, Lap., Ess. Hém. p. 58 (1832); Burm., Handb. Ent. ii (i), p. 352 (1835); Am. & Serv., Hist. Nat. Ins. Hém., p. 173 (1843); Herr. Schaff., Wanz. Ins., vii, p. 78, t. 240, f. 747 (1844); Dallas, List Hem., i, p. 348 (1851); Walker, Cat. Het. iii, p. 482 (1868); Distant, A. M. N. H., (5 s.) iii, p. 45 (1870).

*A. (Aspongopus) Janus*, Stål, En. Hem., i, p. 83 (1870).

Head deep black, immaculate: pronotum rufous, anterior segment black, elevated margin rufous: scutellum black, rufous at the apex: hemelytra rufous; wings black: abdomen black with the elevated margin, rufous: feet black (*Fabr.*). *A. vicinus*, Westw., differs only in the smaller size and the rufescent colour being more luteous. Long, 16 mill.

Reported from Philippines, Java, Borneo, Siam, India, N. Bengal,



Assam, (mihi), Tranquebar, Bombay, Karachi (mihi), Trivandram (mihi).

409. *ASPONGOPUS OCHREUS*, Westwood.

*Aspongopus ochreus*, Westw., Hope Cat. Hem., i, p. 25 (1837); Walker, Cat. Het., iii, p. 483 (1868); Stål, En. Hem., i, p. 85 (1870). Distant, A. M. N. H., (5 s) id., p. 45, 53 (1879).

Entirely luteous-ochraceous. pronotum and scutellum transversely rugose: antennæ and feet fuscous. last joint of antennæ and tarsi pale: body beneath concolorous (*Westw.*) Long, 17-18 mill.

Reported from Bengal.

410 *ASPONGOPUS SICCIFOLIUS*, Westwood.

*Aspongopus siccifolius*, Westw., Hope, Cat. Hem., i, p. 26 (1837) Stål, En. Hem., i, p. 85 (1870) Distant, A. M. N. H. (5 s) iii, p. 45 (1879)  
*Cyclopetta siccifolia*, Dallas, List Hem., i, p. 347 (1851) Walker, Cat. Het., iii, p. 479 (1868).

Obscurely coppery-fuscous, very much punctured; antennæ short, apical joint pale; membrane luteous-fulvous, irregularly reticulated with concolorous veins, pronotum transversely subfoveolate; first femora denticulate beneath (*Westw.*) Body long, 14½-15 mill.

Reported from Ceylon, India, Gogo, N. Bengal, Assam.

411. *ASPONGOPUS NIGRIVENTRIS*, Westwood.

*Aspongopus nigriventris*, Westw., Hope, Cat. Hem., i, p. 26 (1837); Dallas, List Hem., i, p. 349 (1851), Walker, Cat. Het., iii, p. 482 (1868), Vollenhoven, Faune Ent. l'Aroh Indo Néerl., iii, p. 39 (1868) Stål, En. Hem., i, p. 85 (1870). Distant, A. M. N. H. (5 s), iii, p. 45 (1879).

Altogether black-fuscous, above just tinted with cupreous, very finely punctured: pronotum transversely substriated: membrane with about twelve longitudinal veins of which some are forked: last tibiae, a little dilated in the middle (*Westw.*). Long, 17-18 mill. *A. chinensis*, Dallas (List l. c.), differs almost only in having the second joint of the antennæ much longer than the third and may perhaps be united with this. ♂, long, 17-18; ♀, long, 18-19 mill.

Reported from China, Borneo, Sulu, India, Silhat, Assam, Sikkim (mihi).

412. *ASPONGOPUS SANGUINOLENTUS*, Westwood.

*Aspongopus sanguinolentus*, Westwood, Hope, Cat. Hem., i, p. 26 (1837); Dallas, List Hem., i, p. 350 (1851); Walker, Cat. Het., iii, p. 483 (1868); Stål, En. Hem., i, p. 85 (1870).

Closely allied to *A. nigriventris*, Westw., differs especially in having

the abdominal margin sanguineous, last tibiæ simple, and the veins of the membrane less regular and more forked (*Westw.*). Long, 14-15 mill.

Reported from India, Java.

#### 413. *ASPONGOPUS FUSCUS*, Westwood.

*Aspongopus fuscus*, Westwood, Hope, Cat. Hem., i, p. 26 (1837); Dallas, List Hem., i, p. 340 (1851); Walker, Cat. Het., iii, p. 483 (1868); Stål, En. Hem., i, p. 85 (1870); Ölfvers. K. V.-A. Forh., p. 645 (1870).

Closely allied to *A. sanguinolentus*, Westw., and perhaps only a variety of that species; colour more piceous, and interrupted on the luteous sides of the abdomen by black dots; membrane with more areolas at the base (*Westw.*). Long, 15½-16 mill.

Reported from Java.

#### 414. *ASPONGOPUS NEPALENSIS*, Westwood.

*Aspongopus nepalensis*, Westwood, Hope, Cat. Hem., i, p. 26 (1837); Dallas, List Hem., i, p. 340 (1851); Walker, Cat. Het., iii, p. 483 (1868); Stål, En. Hem., i, p. 85 (1870); Distant, A. M. N. H. (5 s.), iii, p. 45 (1879).

Allied to but much longer than *A. nigriventris*, Westw., altogether fuscous-piceous: membrane concolorous with about 12 veins, some of which are forked and areolated at the base: sides of the pronotum almost straight (oblique); last tibiæ a little dilated before the middle (*Westw.*). Long, 18-19 mill.

Reported from Nepál, Silhat, Assam, common in Sikkim (mihi).

#### 415. *ASPONGOPUS UNICOLOR*, Dallas.

*Aspongopus unicolor*, Dallas, List Hem., i, p. 340 (1851); Walker, Cat. Het., iii, p. 480 (1868); Stål, En. Hem., i, p. 85 (1870).

♀. Closely resembles *A. obscurus*, Fabr., entirely fuscous except the black antennæ: body beneath paler than the upper surface: legs brown, posterior tibiæ dilated before the middle and with a long oval pit on the dilated portion: antennæ black with the basal joint brown. Long, 16½-17 mill.

Reported from India?

#### 416. *ASPONGOPUS MARGINALIS*, Dallas.

*Aspongopus marginalis*, Dallas, List Hem., i, p. 350 (1851); Walker, Cat. Het., iii, p. 483 (1868); Stål, En. Hem., i, p. 85 (1870).

♂. Black piceous, somewhat obscure: pronotum and scutellum very thickly and minutely punctured and faintly wrinkled transversely:

membrane brownish: margins of the abdomen banded with black and orange, the middle of each segment being orange: the abdomen is thickly and finely punctured beneath; the margins orange with a black spot on each of the sutures: legs black: antennæ black with the apical joint bright orange; second joint much shorter than the third (*Dallas*). Long, 16-16½ mill.

Reported from Tenasserim.

#### 417. *ASPONGOPUS CIRCUMCINCTUS*, Walker.

*Aspongopus circumcinctus*, Walker, Cat. Het., iii, p. 483 (1838).

Aeneous-black, thickly and very finely punctured, brassy-piceous beneath: eyes piceous: rostrum tawny: antennæ black, second joint a little longer than the third; fourth longer than the second; fifth a little shorter than the fourth: sides of pronotum and of abdomen, testaceous, deeper on the latter: pronotum and scutellum transversely and very slightly striated, the latter piceous at the tip: corium piceous, membrane lurid (*Walker*). Long, 15-16 mill. Allied to *A. Mulleri*, Voll., (Java), but differs in the dark colour of the head and of the under-side of the body and is probably only a local variety.

Reported from India.

#### 418. *ASPONGOPUS NIGRO-AENEUS*, Reuter.

*Aspongopus nigro-aeneus*, Reuter, Ent. Mon. Mag. xvii, p. 294 (1891).

Entirely brassy-black: head, pronotum and scutellum densely and finely punctured, obsoletely transversely rugose: sides of head distinctly sinuate: second joint of the antennæ a little over half longer than the first, 2-3 compressed, third longer than the second: apical margin of the corium slightly rounded: prostethium triangularly impressed in the middle, margins of impression scarcely reflexed. Differs from *A. ochreous*, Westw., in the colour, the impression on the prostethium, being less deep, the denser punctuation, and the faint wrinkles (*Reuter*). Long, 16½ mill.

Reported from Siam.

#### Genus *MEGYMENUM*, Laporte.

Ess. Hém., p. 52 (1832) Boisd., Voy. Astrolabe, Ins., ii, p. 632 (1835): Guérin, Voy. La Ooquille, Ins., ii, p. 171 (1838) Stål, Overs. K. V.-A. Förh., p. 522 (1867): En. Hem., i, p. 86 (1870). Includes:—*Pseudaradus*, Burm., Silb. Rev. Ent., ii, p. 19 (1884): *Amaurus*, Burm., Nov. Act. Acad. Leop. xvi, Suppl. p. 294 (1884): *Platydius*, Westw., Zool. Journ. v., p. 446 (1885).

Head large or somewhat so; jugæ much longer than the tylus and

contiguous before it: antennæ 4-jointed, 2-3 joints much compressed: mesostethium deeply furrowed: bucculæ much elevated, rounded: spiracula of the first ventral segment visible.

Stål distributes the species of this genus amongst the subgenera *Pseudaradus*, *Megymenum*, *Anoplocephala* and *Pissistes*. The two first are found in India, the third in the Eastern Archipelago and the last in China.

*Pseudaradus*:—Head with the sides tumid at the eyes, unarmed: pronotum anteriorly with a tubercle in the middle: lateral margins of the abdominal segments distinctly produced posteriorly in a lobe or tooth; prominulous before the middle, or almost in the middle, in a tooth, or small very obtuse lobule; 2-3 joints of antennæ amplified on both sides.

*Megymenum*:—Head furnished before the eyes on both sides with a tooth, or, oftenest, a very distinct spine: pronotum anteriorly in the middle not, or only very slightly, tumescent: lateral margins of abdominal segments posteriorly distinctly produced in a lobe or tooth, prominulous before the middle, or, in the middle, in a tooth, or very obtuse small lobule: 2-3 joints of the antennæ amplified on both sides.

#### Div. PSEUDARADUS.

##### 419. MEGYMENUM BREVICORNE, Fabricius.

*Osmia brevicornis*, Fabr., Mant. Ins., ii, p. 294 (1787); Gmelin, ed Syst. Nat., (4), p. 2152 (1788).

*Edessa brevicornis*, Fabr., Syst. Rhynch., p. 154 (1803).

*Amaurus brevicornis*, Burmeister, Handb. Ent., ii (i), p. 350 (1835).

*Megymenum brevicorne*, Dallas, List Hem., i, p. 364 (1851); Walker, Cat. Het. iii, p. 500 (1868); Stål, Hem. Fabr., i, p. 38 (1868)

*M. (Pseudaradus) brevicorne*, Stål, En. Hem., i, p. 83 (1870).

Ovate, obscurely cupreous or brassy-black: head black, much canaliculate; antennæ short, compressed: pronotum with the sides expanded, spine anteriorly acute: scutellum and hemelytra obscurely cupreous, immaculate: wings sordidly whitish, abdomen above black, beneath cupreous: feet blackish, first pair of femora dentate inwards (*Fabr.*). Closely allied to *M. inerme*, Herr. Schöff., differs in having the 2-3 joints of the antennæ broader, the former shorter, the latter longer, and the 3-4 joints together longer than the second. The pronotum is unarmed, margins bisinuate; margin of abdomen somewhat dentated. Long, 15 mill.

Reported from China, Assam.

420. *MEGYMENUM INERME*, Herr. Schäffer.

*Amaurus inermis*, Herr. Schäff., Wanz. Ins., v. p. 62, t. 163, f. G. H. (1839).

*Megymenum inermis*, Dallas, List Hem., i, p. 364 (1851); Walker, Cat. Het., iii, p. 501 (1868); Distant, A. M. N. H. (5 s.), iii, p. 45 (1879).

*M. (Pseudaradus) inermis*, Stål, En. Hem., i, p. 66 (1870).

Hardly differs from *M. subpurpurascens*, Westw., except in having the antennæ smaller or more slender, the spines on the anterior angles of the pronotum entirely obtuse, also the angles a little prominent: Long, 15 mill.

Reported from Bengal, Assam, China.

Div. *MEGYMENUM*.421. *MEGYMENUM SUBPURPURASCENS*, Westwood.

*Platydnus subpurpurascens*, Westwood, Zool. Journ., v, p. 446, t. 22, f. 8 (1834).

*Megymenum cupreum*, Guérin, Voy. La Coquille, Zool. Ins., ii, p. 172 (1838); Am. & Serv., Hist. Nat. Ins. Hem., p. 182, t. 3, f. 10 (1843); Dallas, List Hem., i, p. 363 (1851); Vollenhoven, Faune Ent. l'Arch. Indo-Néer., iii, p. 47, t. 4, f. 8 (1868); Walker, Cat. Het., iii, p. 504 (1868).

*Amaurus cupreus*, Herr. Schäff., Wanz. Ins., v p. 61, t. 163, f. 508 (1839).

*Megymenum meratii*, Le Guillou, Rev. Zool., p. 261 (1841).

*M. (Megymenum) subpurpurascens*, Stål, En. Hem., i, p. 67 (1870).

Head, pronotum, scutellum and corium, fuscous-purple: membrane fulvescent and obscurely veined: antennæ and feet black: body beneath purple (*Westw.*). In stature approaching *M. brevicorne*, Fabr., but very close to *M. spinosum*, Burm., from which it differs chiefly in having the angulose posterior part of the pronotum prominulous in a small tooth and the scutellum a little amplified behind the lateral sinus. Le Guillou's, *M. meratii* is described as:—Fuscous black, pronotum with anterior angles acute, lateral margins anteriorly deeply sinuate, dilated behind the sinus: margin of abdomen sinuate, somewhat dentate. Long, body, 14½-15 mill.; breadth of the abdomen, 8-8½ mill.

Reported from New Guinea, Celebes, Ceram, Borneo, Java, Philippines, Siam, Cambodia, Penang, India, Silhat (mihi).

Genus *THALMA*, Walker.

Cat. Het., iii, p. 503 (1868).

Body elliptical, convex, very thickly and minutely punctured: head not longer than broad; jugs contiguous beyond the tylus, rounded on the outer side and the tips, a porrect spine on each side before the eyes which are not prominent: rostrum reaching the last coxæ: antennæ 4-jointed dilated; 2-3 joints dilated; the third much shorter than the second;

fourth fusiform, slender, shorter than the third: pronotum unarmed, sides rounded, posterior angles not prominent, posterior border slightly rounded: scutellum less than half the length of the abdomen, much rounded at the apex: abdomen with the upper apical membrane entire; two broad laminae beneath: legs stout: tarsi 2-jointed, second joint much longer than the first: hemelytra reaching the apex of the abdomen: membrane with five longitudinal veins and with a few transverse veins. Differs from *Megymenum*, in the structure of the pronotum, the less reticulated membrane, the stouter body and the sides of the abdomen not dentate.

#### 422. *THALMA BIGUTTATA*, Walker.

*Thalma biguttata*, Walker, Cat. Het., iii, p. 503 (1868).

Purplish black, dingy ochraceous beneath: antennae black, last joint luteous at the apex: pronotum tinged metallic-green on each side: a luteous dot at base and apex of scutellum: beneath punctured black, pectus with three irregular black stripes faintly visible on the venter: abdomen above with luteous spots along each side: legs black: hemelytra blackish; corium beneath dingy testaceous; wings purplish blue (*Walker*). Long, 16½ mill.

Reported from Amboina, Burma (?).

#### Genus *ATELIDES*, Dallas.

A. M. N. H., (2 s.) x, p. 359, 436 (1852): Walker, Cat. Het., iii, p. 500 (1868). Stål, Öfvers. K. V.-A. Forh., p. 522 (1867); En. Hom., i p. 89 (1870).

Body somewhat ovate, broadest behind the middle: head foliaceous; juga reflexed at the sides, much longer than the tylus, with their inner margins contiguous throughout nearly their whole length, gaping slightly at the apex; tylus very small; lateral margins with a strong spine in front of the eyes: eyes very prominent: ocelli small, placed close to the base of the head and about equally distant from one another and from the eyes: antennae 4-jointed, stout, basal joint short, not extending beyond the apex of the head; 2-3 joints prismatic; the second longer than 3-4 together, furnished with three longitudinal furrows; third joint black and hirsute like the second; fourth orange, somewhat pilose, with the base black, perhaps a little longer than the third, elliptical, elongate; 3-4 joints much thinner than the second: rostrum rather slender, reaching the intermediate coxae, inserted about the middle of the under surface of the head, between two somewhat triangular lamellae; basal joint rather stout, passing the anterior margin of the prosternum; second joint longest, thinner than the first; third joint shorter than the first, about equal to it in thickness; fourth joint shortest and thinnest:

pronotum subquadrate, rather narrower in front than behind, lateral angles slightly spinose: scutellum short and broad, with the apex broad and rounded: hemelytra very short, covering only the two first segments of the abdomen (not always), with their apical margin truncated, somewhat membranous: sternum with a narrow longitudinal canal: abdomen nearly circular, slightly convex above, very convex beneath, with the apex somewhat truncated: the two lateral vulvar plates bearing stigmata: legs stout, femora unarmed; tibiae prismatic, the posterior pair slightly dilated internally and channelled beneath; anal apparatus, in ♂, seen from beneath, appears to consist of a plate of a semicircular form, broadly notched on its posterior margin and occupying a broad emargination of the last segment of the abdomen; seen from above, it presents a circular corneous ring, the upper portion of which is very narrow, whilst the lower portion is produced and emarginate posteriorly: the opening of the ring is narrowed irregularly by a large tooth on each side, close to which the margin of the ring is clothed with yellowish hairs.

423. *ATELIDES CENTROLINEATUS*, Dallas.

*Astelides centrolineatus*, Dallas, A. M. N. H., (2 s.) x, p. 326, 436, t. 5, f. 1-5 (1852): Walker, Cat. Het., iii, p. 500 (1868) Stål, En. Hem., i, p. 89 (1870).

♀. Head above, brassy black, somewhat obscure, rather finely rugose, with the lateral margins tinged with chestnut, and with a longitudinal orange yellow band down the middle; beneath brownish fulvous, with the orbits brassy: eyes brown; ocelli yellow: antennae with the first two joints black, thickly clothed with short stiff hairs, but with the furrows of the second joint naked; basal joint fulvous at the base; apical joint fulvous: rostrum pale chestnut with the basal joint fulvous: pronotum blackish, somewhat brassy, with the annular spots near the anterior margin and an indistinct patch within each lateral angle chestnut, the surface minutely punctured and wrinkled transversely; the disc with a smooth orange-yellow band continuous with that on the head; the sides broadly margined with dull orange, with the extreme edges black: scutellum black, very thickly and minutely punctured and transversely wrinkled, with a smooth orange-yellow band continuous with that on the thorax: pectus brownish fulvous, sparingly punctured, with a broad, brassy black, rugose longitudinal band on each side within the lateral margins: legs pale chestnut brown: hemelytra blackish, somewhat brassy, finely granulose; outer margin broadly fulvous, edged with black; the submarginal vein, a streak on the disc and the base of the inner margin fulvous; membrane brown: abdomen above blackish, somewhat brassy, finely granulose, with the sides dull chestnut irrorated with black points; the middle with a longitudinal orange band continuous

with that on the scutellum: margins pale chestnut-brown, with the edges and a band on each of the sutures black; abdomen beneath pale chestnut-brown, minutely granulated, with a blackish brassy band down each side within the line of stigmata: stigmata black; apical and lateral vulvar plates edged with black (*Dallas*). ♀, long, 19-20; ♂, 16-17 mill.

Reported from Silhat. The Indian Museum has specimens from Assam.

Add:—*Sagriva vittata*, Spin., Gen. Ins. Art., p. 117 (1852).

#### Subfam. PHYLLOCEPHALINA, Stål.

Ölvera. K. V.-A. Forh., p. 645 (1870); l. c. (8), p. 32 (1872): En. Hem., v, p. 117 (1876):—*Phyllocephalida*, Dallas, List Hem., i, p. 350 (1851):—*Phyllocephalida*, Stål, Hem. Afric., i, p. 32, 234 (1864).

(a) As in Subfam. PENTATOMINA (Jl. Pt. II, p. 192, 1887).

(b)—Rostrum short, not extended behind the first coxæ, two basal joints very short, entirely, or for the greatest part, hidden between the bucculæ: head usually foliaceous or elongated and triangular, with the juga produced to a distance before the tylus, and usually contiguous: spiracula of the basal ventral segment hidden by the posterior part of the metastethium: tarsi 3-jointed: antennæ 5-jointed.

#### Genus CRESSONA, Dallas.

List Hem., i, p. 355 (1851): Walker, Cat. Het., iii, p. 494 (1868): Stål, Hem. Afric., i, p. 234 (1864); En. Hem., v, p. 117, 118 (1876).

Body oblong, ovate: head small, gradually narrowed anteriorly, rounded at the apex, sides less strongly dilated; juga contiguous at the apex, not much longer than the tylus; entire antenniferous tubercles prominulous beyond the sides of the head: eyes moderate; ocelli distant, placed very close to the eyes: antennæ 5-jointed, about as long as the head and pronotum, rather stout, basal joint short and stout, passing the apex of the head, remainder nearly equal in length: rostrum 4-jointed, passing the anterior coxæ, rather stout, basal joint very short, entirely concealed within the deep groove on the underside of the head, third joint longest, fourth a little longer than the second: furrow of the orifices long: pronotum with the lateral angles produced into long, stout, straight horns which project forwards beyond the apex of the head and are somewhat compressed towards the apex which is notched; lateral margins of the pronotum strongly dentate, the denticulations continued along the under surface of the lateral horns and terminating a little before the apex of these in a large flat tooth: scutellum of the usual form



and size; frena extended beyond the middle of the scutellum: membrane with longitudinal veins: legs stout, tibiae quadrangular with the angles prominent, especially on the anterior pair; tarsi 3-jointed, basal joint longest (*Dallas*).

424. *CRESSONA VALIDA*, Dallas.

*Cressona valida*, List Hem., i, p. 358, t. 11, f. 3 (1851); Walker, Cat. Het., iii, p. 494 (1868); Stål, En. Hem., v, p. 118 (1876).

♀. Entirely ochreous, densely and finely punctured: pronotum with two close longitudinal lines of brown punctures down the middle: coriaceous part of the hemelytra with some more or less distinct, black points on the middle of the disc; membrane brownish, semitransparent, with numerous brown points: wings transparent, nearly colourless: abdomen above, brown at the base and within the lateral margins; margins ochreous, punctured: abdomen beneath, thickly punctured with brown, and with numerous black points; 3-5 segments each with a large whitish patch on each side of the disc: pectus brownish obscure with a large shining castaneous-brown patch on each side of the mesostethium: legs concolorous, femora covered with brown points: rostrum with the tip black: antennae testaceous, covered with brown points, last joint brown with the base testaceous (*Dallas*). Long, 25 mill.

Reported from India: Sikkim (mibi)

Genus *DALSINA*, Am. & Serv.

Hist. Nat. Ins. Flém., p. 175 (1843); *Phyllocephala*, pt., Dallas, List Hem., i, p. 352, (1851); Walker, Cat. Het., iii, p. 492 (1868); Stål, En. Hem., v, p. 118, 119 (1876).

Head short, almost equally long and broad: antennae longer than the pronotum: rostrum extending beyond the insertion of the anterior feet: lateral margins of the pronotum rounded, posterior margin truncated, almost straight: scutellum extending a little beyond the middle of the abdomen, sinuated on the sides: membrane almost as large as the coriaceous portion, more or less transparent, with rather regular longitudinal veins: wings a little shorter than the abdomen which is rather a little tumid beneath: feet tolerably robust and short, nearly equal in length (*Am. & Serv.*).

425. *DALSIRA GLANDULOSA*, Wolff.

*Bdessa glandulosa*, Wolff, Ic. Cim., v, p. 176, t. 17, f. 170 (1811).

*Aelia glandulosa*, Burm., Handb. Ent., ii (1), p. 357 (1835).

*Phyllocephala glandulosa*, Dallas, List Hem., i, p. 353 (1851); Walker, Cat. Het., iii, p. 402 (1868).

*Dalsira glandulosa*, Stål, En. Hem., v, p. 119 (1876); Distant, A. M. N. H., (5 s) iii, p. 45 (1879).

Antennæ 5-jointed, filiform, black, first joint short: head, pronotum, scutellum and hemelytra obscurely ferruginous; head rounded at the apex, impressly punctured, lateral margins somewhat elevated, impressed at the apex with two small lines which diverge posteriorly; ocelli behind the greyish eyes, distant; rostrum 4-jointed, very short, black, placed between two rounded plates at the base: pronotum impressly punctured, convex, posterior angles prominent, somewhat acute: scutellum longer than half the abdomen, impressly punctured and very finely transversely rugose, with a large deep black, marginal gland on each side at the base, transversely rugose, oblong, placed obliquely, posteriorly girth with a somewhat tumid border: hemelytra very finely impressly punctured, with six yellow longitudinal lines alternately abbreviated; membrane fuscous, striated whitish: wings cinerous, veins fuscous: abdomen above fuscous, margin paler, somewhat dentated; beneath brunneous, with a row of elevated points on both sides: pectus concolorous, impressly punctured: anus obtuse: feet unarmed; femora fuscous, with two ferruginous longitudinal lines; tibiæ angulated, ferruginous, exterior side with 4-5 deep black points: tarsi fuscous, 3-jointed (Wolff). Long, 23 mill.

Reported from China, Bengal, Assam (mihi).

Genus *BASICRYPTUS*, Herrich-Schäffer.

Wans. Ins., VII, p. 81 (1844) Stål, En. Hem., v, p. 119 (1876):—*Phyllocephala*, pt., Dallas, List Hem., i, p. 352 (1851); Walker, Cat. Het., iii, p. 487 (1868).

Dallas included *Phyllocephala*, Lap., *Dalsira*, Am. & Serv., *Schisope*, Spinola, and *Basicryptus*, Herr. Schöff., in his genus *Phyllocephala*. The three last occur in India and near them lies *Gonopsis*: they may be thus differentiated:—

1-6. Pectus without a levigate streak near the coxæ.

2-5. Scutellum without a flavescent, continued streak.

3-4. Costal margin not, unless anteriorly, levigate or sparingly punctate:—*Dalsira*.

4-3. Costal margin of corium entirely pale, levigate and smoothish, sometimes marked by transverse spots or impressions, or by black points arranged in remote transverse rows:—*Basicryptus*.

5-2. Continued lateral streak on scutellum, intramarginal before, the middle, marginal behind the middle, also entire costal limb, flavescens:—*Schizope*.

6-1. Pectus with a levigate lateral streak (posteriorly abbreviated) near the coxæ; the streak generally pale:—*Gonopsis*.

First joint of rostrum is hidden between the oval lateral pieces of the head beneath; second joint free, shortest; 3-4 of equal length; third reaching first coxæ; the fourth reaches the middle of the carinate mesosternum: membrane hardly half the size of the coriaceous portion of the hemelytra.

#### Genus BASICRYPTUS, Herr. Schöff.

Wanz. Ins., vii, p. 83 (1844) · Stål, En. Hem., v, p. 119 (1876).

Juga rounded at the apex, contiguous beyond the tylus; first joint of rostrum entirely hidden, second shortest, 3-4 equally long, third reaches the first pair of feet, fourth the middle of the finely ridged mesostethium: membrane half as large as the coriaceous portion.

#### 426. BASICRYPTUS ILLUMINATUS, Distant.

*Basicyptus illuminatus*, Dist., Trans. Ent. Soc., p. 358 (1887).

Body above dull dark reddish, pronotum with a broad, discal, transverse, luteous band, margined black, attenuated at each end, and slightly notched at the middle: eyes dull ochraceous; 1-3 joints of antennæ reddish: lateral margins of the pronotum somewhat finely crenulated, the lateral angles broadly and subacutely produced: scutellum with a small luteous spot in each basal angle and a few very small luteous spots at the apex, and with some median and lateral black punctures: base of lateral margin of corium narrowly luteous, and with some very small and irregular scattered black spots: membrane pale hyaline, somewhat thickly ornamented with small fuscous spots: body beneath and legs dull reddish, with black punctures: disc of sternum and some sublateral streaks to abdomen obscure luteous: tarsal joint somewhat ochraceous beneath (*Dist.*). Long, 14; exp. angl. pron., 10 mill.

Reported from N. India.

#### Genus SCHIZOPS, Spinola.

*Schizops*, Ess., p. 287 (1837) : *Schizops*, Am. & Serv., Hist. Nat. Ins. Hém., p. 176 (1843) ; Stål, pt., Hem. Afric., i, p. 234, 239 (1864) ; En. Hem., v, p. 118, 120 (1876).

Head triangular, juga produced much beyond the tylus and forming the apex of the triangle, rounded, bifid, the cleft very narrow, contracted

hindwards and reduced near the end of the tylus to a simple impression where about two other like impressions that mark the separation of the three lobes: labrum and rostral canal start from the end of the tylus, the former is transversely striated and covers the whole of the first and at least half the second joint of the rostrum: head beneath convex; the rostral canal does not reach its base and receives the whole of the first joint of the pronotum and part of the second joint; the rostrum does not reach the mesostethium, the apex of its fourth joint rests on the posterior margin of the prostethium between the first pair of feet; there is no ventral groove: prostethium flat, acuminate, its sides with a simple margin: mesostethium flat, apex tumid, concealing the middle of the first segment: the second segment without spine or protuberance, venter uniformly convex and even somewhat tumid: femora simple; tibiae triangular, edges not dilated; first joint of tarsi as long as the other two together: abdomen extending beyond the hemelytra: membrane occupying one-third of the hemelytra, veins variable.

Differs from *Dalsira*, Am. & Serv., in having the lateral streak continued through the scutellum, intramarginal before the middle, marginal behind the middle, also costal limbus, entirely flavescent.

#### 427. SCHIZOPS INSIGNIS, Walkor.

*Schizmatops insignis*, Walker, Cat. Het. in, p. 495 (1868).

*Schizops insignis*, Stål, En. Hem., v, p. 120 (1876).

Tawny, very thickly and minutely punctured, slightly clouded with blackish beneath: head a little longer than its breadth; juga lanceolate, contiguous, except at their tips: eyes livid, not prominent: rostrum extending to the first coxæ: antennæ black; second joint a little longer than the third: pronotum between the hind angles with a transverse ridge and an anterior slight metallic-green transverse furrow, the latter abbreviated at each end; space between the ridge and the hind border mostly piceous; hind angles acute, prominent: scutellum piceous, rounded at the tip, with two testaceous stripes which are bordered with bright green on the outer side near the base: legs tawny: hemelytra piceous; costa testaceous; membrane cinereous with many black points (*Walker*). Body long, 17-18 mill.

Reported from Burma

Genus GONOPSIS, Amyot & Serville

Hist. Nat. Ins. Hem., p. 180 (1843). Stål, En. Hem., v, p. 121 (1876).

Allied to *Megarhynchus*, Lap.: head with the juga distant: posterior angles of pronotum very prominent in a pointed spine: extremity of ab-

domen, in ♂, almost straightly truncate; in ♀, slightly roundly emarginate (*Am. & Serv.*).

#### 428. GONOPSIS RUBESCENS, Distant.

*Gonopsis rubescens*, Dist., Trans. Ent. Soc., p. 359 (1887).

Body above sanguineous: head somewhat obscurely punctate, antennæ reddish, third joint shorter than second or fourth, fifth joint longest and pilose: lateral margins of the pronotum finely crenulate, the lateral angles produced into short subacute spines between which is a transverse ridge, before which the surface is obliquely deflected towards the head; pronotum is also transversely rugulose, except two levigate spots on the anterior area: scutellum longitudinally rugose, with a row of black punctures on the basal half of the lateral margins; corium obscurely punctate and finely rugulose, with a few black punctures near the inner apical angle: membrane pale hyaline: body beneath and legs pale reddish; the body is very finely and darkly punctate, and the tibiae have a fuscous spot on under side of apices (*Dist.*). Long, 14; exp. angl. pron., 7 mill.

Reported from Sikkim.

#### Genus DIPLORHINUS, Am. & Serv.

Hist. Nat. Ins. Hem., p. 178 (1843). Dallas, List. Hem., i, p. 359 (1851); Walker Cat. Het., ii, p. 491 (1868). Stål, En. Hem., v, p. 118, 122 (1876).

Juga prolonged, broad, divaricate, pointed: 2-3 joints of the antennæ of equal length: pronotum posteriorly rugose and strongly punctured, lateral angles produced in a process which is obtuse or abruptly somewhat acuminate at the apex, turning outwards, sides crenulate: scutellum less strongly punctured than the pronotum: veins of membrane, straight, black on a pale ground: posterior tibiae straight.

#### 429. DIPLORHINUS QUADRICORNIS, Stål.

*Diplorhinus quadricornis*, Stål, En. Hem., v, p. 122 (1876).

♂. Very close to *D. furcatus*, Westw., differs in the longer juga, gradually acuminate, more divaricate, furnished with straight lateral margins; pronotum more strongly rugose, lateral margins more remotely and more obtusely denticulate, process of the lateral angles twice as long, body narrower (*Stål*). Long, 20; broad,  $8\frac{1}{2}$ ; breadth of pronotal processes,  $12\frac{1}{2}$  mill.

Reported from N. E. India, Assam (mihi).

430. *DIPLOBRINUS FURCATUS*, Westwood.

*Atelocerus* ? *furcatus*, Westwood, Hope, Cat. Hem., i, p. 20 (1837).

*Phyllocephala distans*, Herr. Schaff., Wana. Ins., vii, p. 71, t. 237, f. 740 (1844).

*Orthoschizops* ? *furcata*, Walker, Cat. Het., i, p. 232 (1867).

*Diplobrinus furcatus*, Am. & Serv., Hist. Nat. Ins. Hém., p. 178, t. 3, f. 6 (1843); Dallas, List Hem., i, p. 359 (1851); Walker, l. c. iii, p. 494 (1868): Voll., Fauna Ent. l'Arch. Ind Néerl., iii, p. 41 (1868). Stal, En. Hem., v, p. 122 (1876).

Fuscous: hemelytra and scutellum a little paler: head large, porrect, bifurcate: antennæ short, very slender, pale: pronotum scabrous, sides serrate and posteriorly produced on both sides in a prominent angle: median line on hemelytra, blackish: membrane hyaline, with eight straight, black, longitudinal veins: feet lutescent (*Westw.*). In *P. distans*, H. S., the lateral margin of the hemelytra and a small longitudinal line at base of the scutellum are ochreous; beneath dark brown, more red-brown posteriorly: feet yellow-brown. Long, 18-19 mill.

Reported from Java. Sumatra.

Genus *MACRINA*, Amyot & Serville.

Hist. Nat. Ins. Hém., p. 179 (1843) pt., Dallas, List Hem., i, p. 360 (1851); Walker, Cat. Het., iii, p. 496 (1868) Stål, Hem. Afric., i, p. 234, 244 (1864); En. Hem., v, p. 118, 122 (1876).

Body oblong-ovate: head triangular; jugæ flat, very acute, contiguous or somewhat so; in Indian species, the second joint of the antennæ extends at least by half beyond the apex of the head: sides of pronotum produced behind the middle in a gradually acuminate process, turning outwards and more or less forwards: posterior angles of the genitalia, in ♂, hardly prominulous, rounded.

431. *MACRINA DILATATA*, Distant.

*Macrina dilatata*, Distant, A. M. N. H., (5 s) iii, p. 45, 52 (1879): Waterhouse, Aid., t. 6.

Broad, ovate: head broad, triangular, moderately covered with deep dark punctures; jugæ slightly sinuated, divided at the apex, meeting beyond the tylus which is much shorter: antennæ with the third joint shortest; fourth rather longer; fifth longest, black, with the base rufous (the first four joints vary in different specimens from rufous to luteous): rostrum reaching anterior coxæ: pronotum with the base slightly rugulose, somewhat crescent-shaped in front where it is bordered with a pale luteous band between the lateral angles, which are produced into two stout spines directed forwards; spinal apices black: anterior portion of the pronotum abruptly deflexed to the head, transversely costate, mo-

derately punctured with brown; lateral borders denticulated: scutellum reaching beyond the base of the membrane, with five longitudinal, indistinct, somewhat catenulate elevated ridges, which are sprinkled with luteous, the median ridge generally most indistinct: membrane pale fuscous, extending beyond the apex of the abdomen: beneath and legs concolorous, thickly and finely punctured with brown: tibiæ sulcated (*Distant*). ♂, long 16, breadth at base of corium 8; exp. angles pronot. 11 millims. ♀, long 17, breadth at base of corium,  $8\frac{1}{2}$ , exp. angles pronot. 12 mill.

This species approaches *M. coccinea*, Walker, but differs in its much greater breadth: some specimens are of a much darker colour than others.

Reported from the Naga hills 2000-6000 feet, N. Khasiya hills 1500-3000 feet.

#### 432. *MACRINA COCCINEA*, Walker.

*Macrina coccinea*, Walker, Cat. Het., iii, p. 49 (1876); *Distant*, A. M. N. H., (5 s.), iii, p. 45 (1879).

Bright red, very elongate-oval; head acute, a little longer than broad; tylus transversely striated; jugæ contiguous, obliquely striated: eyes not prominent: rostrum partly black, extending to the first coxæ: antennæ slender; second joint much longer than the third, as long as the fourth; fifth longer than the fourth, sometimes mostly black: pronotum and scutellum transversely rugulose; the former with a ridge between the posterior angles, which are acute, elongated and slightly inclined forward; sides in front serrated; a transverse, sometimes testaceous, callus on each side near the anterior margins: scutellum much attenuated, rounded at the tip, with a few or many yellow speckles: abdomen truncated at the tip; legs slender: hemelytra thickly and minutely punctured; membrane pellucid (*Walker*). Body long,  $14\frac{1}{2}$ -15 mill.

Reported from Penang, India, Assam, Sikkim (mihi).

#### Genus *TETRODA*, Am. & Serv.

Hist. Nat. Ins. Hém., p. 177 (1843); Dallas, List Hem., i, p. 355 (1851); Walker, Cat. Het., iii, p. 493 (1868); Stål, Hem. Afric., i, p. 234 (1864); En. Hem., v., p. 118, 123 (1876).

Head with the jugæ long, gradually acuminate, slightly diverging outwards, somewhat straight, and tip slightly rounded; narrowed from the eyes, not incised at the eyes, lateral margins for the most part straight: second joint of antennæ a little shorter than the third, rest

almost equal in length: sides of pronotum laminated, produced anteriorly in a depressed porrect process, sides scarcely crenulate: scutellum extending scarcely beyond the middle of the abdomen, ending in a rounded point: veins of membrane rather straight.

#### 433. TETRODES HISTEROIDES, Fabricius.

*Acanthia histeroides*, Fabr., Ent. Syst. Suppt. p. 526 (1798).

*Aelia furcata*, Fabr., Syst. Rhynch., p. 188 (1803): Stoll, Punaisses, p. 109, t. 28, f. 197 (1798).

*Aelia histeroides*, Fabr., Syst. Rhynch., p. 189 (1803).

*Phyllocephala furcata*, Herr. Schaff., Wanz. Ins., vii, p. 70, t. 237, f. 738 (1844).

*Megarhynchus 4-spinosus*, Westw., Hope, Cat. Hom., i, p. 19 (1837); Walker, l. c. p. 493 (1868)?

*Tetroda histeroides*, var. *sumatrana*, Ellonr. Nat. Tijds. v. Ned. Ind., xxiv, p. 171 (1862).

*Tetroda histeroides*, Am. & Serv., Hist. Nat. Ins. Hém., p. 178 (1843); Dallas, List Hem., i, p. 356 (1851); Walker, Cat. Het., iii, p. 493 (1868); Stål, Hem. Fabr., i, p. 41 (1868); En. Hem., v, p. 122 (1876); Vollenhoven, Faune Ent. l'Arch. Indo-Néer., iii, p. 41 (1868); Distant, A. M. N. H., (5 s.), iii, p. 45 (1879); Scott, Trans. Ent. Soc., p. 306 (1880).

Head black, bifid, with the rostrum inserted below the lobes; pronotum obscure, flat, the anterior angle much produced on both sides, somewhat spinose: scutellum black with a white marginal line on both sides: hemelytra black: body obscure (*Fabr.*). Long, 17 mill.

Reported from Java, Burma, Bengal, Sikkim (mihi), Assam (mihi), Sinkip island.

#### 434. TETRODA DIVARICATA, Dallas.

*Tetroda divaricata*, Dallas, List Hem., i, p. 356 (1851); Walker, Cat. Het., iii, p. 493 (1868); Stål, En. Hem., v, p. 124 (1876).

♂. Fuscous, punctured: juga divaricate: membrane whitish, veins black: body beneath more obscure: antennæ black, two basal joints fuscous (*Dallas*). Long, 13-14 mill. Hardly different from *T. histeroides*, Fabr.

Reported from Nepál, Sikkim (mihi).

435. *Tetroda atomaria*, Dallas, List Hem., i, p. 356 (1851); Walker, Cat. Het., iii, p. 493 (1868).

♂. Head testaceous, thickly and faintly punctured; juga nearly meeting at the apex, lateral margins straight: pronotum with the anterior portion testaceous, obscure, punctured, becoming dark brown posteriorly, with numerous small elevated testaceous points: scutellum



dark brown, nearly black, punctured, with numerous small warts similar to those on the pronotum, and on each side at the base a yellow impunctate line, which tapers to a point posteriorly: coriaceous portion of the hemelytra dark brown, punctured, with several irregular longitudinal testaceous lines formed of small raised points; membrane whitish, opaque: body beneath testaceous, with an interrupted black band down each side within the lateral margin, on the line of the stigmata; stigmata white: pectus punctured with brown: legs testaceous; femora punctured with brown: rostrum pale testaceous: antennae yellowish-white (*Dallas*). Long,  $12\frac{1}{2}$  mill.

Reported from N. India.

#### 436. TETRODA BILINEATA, Walker

*Tetroda bilineata* Walker, Cat. Het., iii, p. 494 (1868)

Fawn-colour or blackish, or of an intermediate hue, very thickly and minutely punctured: head very much longer than broad; jugæ separate, lanceolate, twice the length of the tylus: eyes rather prominent: rostrum extending to the first coxæ: antennæ black, about one third the length of the body; second joint a little longer than the third; fourth longer than the second; fifth a little longer than the fourth: pronotum and scutellum transversely and slightly striated: pronotum with the anterior angles porrect, much elongated, very acute: scutellum attenuated rounded at the tip, with two whitish stripes which taper and converge from the base nearly to the tip and are bordered with black on the outer side: abdomen beneath in the blackish individuals of a dull dark red hue: membrane cinereous; veins black (*Walker*). Body long, 14-17 mill.

Reported from Java, Sumatra, Malacca, Burma, India, Sikkim (mihi).

#### Genus GELLIA, Stål.

Hem. Afric., i, p. 234, 243 (1861); En. Hem., v, p. 118, 122 (1876).

Body oval: head much dilated, foliaceous, lateral margins distinctly incised at the eyes, abruptly dilated at the eyes and forming an angle, thence rounded before the incisure; jugæ very slightly distant: anterior lateral margins of the pronotum produced forwards in a depressed lobe.

#### 437. GELLIA NIGRIPENNIS, Dallas.

*Tetroda nigrispennis*, Dallas, List Hem., i, p. 357 (1851); Walker, Cat. Het., iii, p. 493 (1868).

*Gellia nigrispennis*, Stål, En. Hem., v, p. 123 (1876).

♂. Reddish testaceous, thickly and finely punctured: head with

the lateral margins abruptly dilated a little before the eyes; juga foliaceous, rounded externally and nearly meeting at the apex: pronotum faintly rugose transversely, and with a distinct transverse ridge not far from the posterior margin: scutellum with its lateral margins brownish and with a black streak at each side at the base: hemelytra with the disc brownish; membrane black: margins of the abdomen ferruginous: body beneath with an irregular blackish band on each side on the line of the stigmata which are white: legs testaceous; tibiae at the apex and the tarsi ferruginous: rostrum and antennae testaceous, the latter somewhat ferruginous (*Dallas*). Long, 12½-13 mill.

Reported from N. India, Karachi (mihi).

#### 438. GELLIA OBTUSA, Dallas.

*Tetroda obtusa*, Dallas, List Hem., i, p. 357 (1851); Walker, Cat. Het., iii, p. 493 (1868).

*Gellia* (?) *obtusa*, Stål, En. Hem., v, p. 124 (1876).

♂. Testaceous, very thickly and finely punctured: head with the juga foliaceous, rounded at the apex, with the inner angles obtuse, not meeting; lateral margins with a minute black spine, tipped with yellow, on each side in front of the eyes: pronotum with an indistinct, transverse ridge near the hinder margin: scutellum with several scattered black points, and a black streak on each side at the base: membrane whitish, opaque: abdomen beneath thickly and rather coarsely punctured, with a large transverse impunctate pit on each side of each segment, touching the posterior margin of the preceding segment; the space around each of the stigmata with an irregular patch of black punctures: pectus rather coarsely punctured, with a few scattered black points, and a black shining spot on each side of the metastethium: legs testaceous; femora with brown points: rostrum testaceous, with the apex black: antennae testaceous (*Dallas*). Long, 13½-14 mill.

Reported from N. India.

#### Genus MEGARHYNCHUS, Lap.

Ess. Hém., p. 65 (1832): Am. & Serv., Hist. Nat. Ins. Hém., p. 179 (1843): Dallas, List Hem., i, p. 361 (1851): Walker, Cat. Het., iii, p. 498 (1868): Stål, Hem. Afric., i, p. 234 (1864); En. Hem., v, p. 118, 123 (1876).

Body very elongate: head very long, ending in a sharp, bifid point, the bifurcation so close as to appear above but a longitudinal groove in the middle of the head: eyes very small, hardly prominulous: antennae long, 6-jointed, first very short, rest of equal length to each other: rostrum very short, hardly reaching the insertion of the first pair of feet,

joints rather equal: pronotum nearly continuing the triangle formed by the head, without posterior spines turning forwards; posterior angles not prominulous: scutellum elongate, rounded at the tip, extending a little beyond the half of the abdomen: hemelytra hardly allowing the margin of the abdomen to be seen; membrane shorter than the coriaceous portion: wings shorter than the hemelytra: abdomen flat above, slightly tumid beneath, elongate, as broad at its base as the pronotum, gradually narrowing and abruptly truncate at the tip, nearly at the end of the hemelytra: feet robust, long, unarmed; tarsi long (*Am. & Serv.*).

#### 439. MEGARHYNCHUS ROSTRATUS, Fabricius.

*Aelia rostrata*, Fabr., *Syst. Rhynch.*, p. 188 (1803) *Burm., Handb. Ent.* ii (i), p. 357 (1835)

*Lygaeus hastatus*, Fabr., *Syst. Rhynch.*, p. 289 (1803).

*Megarhynchus elongatus*, Laporte, *Ess. Hém.*, p. 65 (1832).

*Megarhynchus hastatus*, Dallas, *List Hem.*, i, p. 361 (1851); Walker, *Cat. Hem.* iii, p. 498 (1868). *Voll., Fauna Ent. Ind. Néer.*, ii, p. 42 (1868).

*Megarhynchus rostratus*, *Am. & Serv.*, *Hist. Nat. Ins. Hém.*, p. 180 (1848); Herr. Schaff, *Wanz. Ins.*, ix, p. 303, t. 322, f. 999 (1853); *Ellenr. Nat. Tijdschr. Ned. Ind.*, xxiv, p. 172, f. 31 (1862); Stål, *Hem. Fabr.*, i, p. 41 (1868); *Ofvers. K. V.-A. Förh.*, p. 645 (1870); *Eu. Hem.*, v, p. 123 (1876).

Clypeus of the head very long, bifid, with acute lobes; head, pronotum, hemelytra, body and feet, cinereous, immaculate; antennæ alone entirely rufous (*Æ. rostrata*, Fabr.). Very elongate: head porrect, subulate, acute, sulcate in the middle: antennæ inserted beneath the head, pale at the base, rufous at the apex: pronotum smooth, a little produced on both sides posteriorly, pale deep black before the margin: the margin itself white: scutellum elongate, smooth, flavescent; margin white: hemelytra ferruginous, margin white: wings hyaline: body flavescent, with a deep black spot on both sides at the apex (*L. hastatus*, Fabr.). Long, 20 mill.

Reported from Philippines, Java, Sumatra, Cambodia, Cochin-China, Siam, Burma, India, China, Sikkim (mibi).

#### 440. MEGARHYNCHUS TRUNCATUS, Westwood.

*Megarhynchus truncatus*, West., *Hope, Cat. Hem.*, i, p. 20 (1837); Dallas, *List Hem.*, i, p. 361 (1853); Walker, *Cat. Hem.*, iii, p. 498 (1868); *Voll., Faune l'Areh. Ind. Néer.*, iii, p. 43 (1868); Stål, *Eu. Hem.*, v, p. 123 (1876).

*Megarhynchus testaceus*, *Am. & Serv.*, *Hist. Nat. Ins. Hém.*, p. 180 (1848); Walker, *l. c.*, iii, p. 498 (1868).

Large: sub-parallel, testaceous-luteous, punctured fuscous: head acuminate, scarcely bifid, pronotum simple, as broad as the abdomen,

sides oblique, serrated: hemelytra fuscous, marked with pale lines: apex of the abdomen truncated (*Westw.*). Form somewhat similar to the broader examples of *M. rostratus*, Fabr., head and pronotum punctured fuscous; anterior lateral margins of the pronotum narrowly pallescent, not so strongly transversely rugose; distinct median longitudinal line and fine anterior transverse wrinkle levigate; posterior angles produced in an acuminate tooth (*Stål*). Long, 21 mill.

Reported from Java, Penang, India, China, Assam (mihi).

#### 441. MEGARHYNCHUS LIMATUS, Herr. Schöff.

*Megarhynchus limatus*, Herr. Schöff., Wanz. Ins., ix, p. 303, t. 322, f. 998 (1853): Stål, En. Hem., v, p. 124 (1876): Distant, A. M. N. H., (5 s.), iii, p. 45 (1879).

Elongate-obovate, broadest over the pronotum: head bifid, a little longer than broad: pronotum and scutellum grossly punctured, transversely rugose: sides of pronotum serrulate, roundly prominulous and moderately acute, though the angles are hardly prominent: scutellum with five weakly elevated longitudinal lines: the hemelytra finely punctured between the elevated veins: dark ochreous yellow; the feet more ferruginous; hemelytra between the veins, purple-red. Like and closely allied to *M. truncatus*, Westw., from which it differs in having head and pronotum shorter, stature broader, punctuation stronger, concolorous or weakly ferruginous, rarely fuscous on the head: the lateral margins of the pronotum are not pallescent, they are strongly rugose, posterior angles slightly and somewhat obtusely prominulous, no levigate longitudinal line or only a very obsolete one, no anterior transverse wrinkle or ridge. Long, 20-21 mill.

Reported from Assam (mihi).

#### 442. MEGARHYNCHUS TRANSVERSALIS, Westwood.

*Tetroda transversalis*, Westw. in Royle's Ill. Bot. Him., p. liv, t. 10, f. 7 (1839): Dallas, List Hem., i, p. 356 (1851); Walker, Cat. Het., iii, p. 493 (1868).

*Megarhynchus* (?) *transversalis*, Stål, En. Hem., v, p. 124 (1876).

Fuscous-black: acutely bicornuted; anterior angles of pronotum produced acutely forwards: pronotum and scutellum transversely striated: corium black, very thinly punctured; membrane whitish: antennæ and feet black (*Westw.*). Long,  $15\frac{1}{2}$ ; broad,  $7\frac{1}{4}$  mill.

Reported from the Himalaya.

#### 443. MEGARHYNCHUS DIVERSUS, Walker.

*Megarhynchus diversus*, Walker, Cat. Het., iii, p. 498 (1868).

Testaceous, subfusiform, narrowest at the tip of the abdomen, thick-

ly and minutely punctured; some of the punctures black: head a little longer than broad; juga lanceolate, connected: eyes not at all prominent: rostrum extending to the fore coxæ: antennæ slender, second joint much longer than the third, as long as the fourth; fifth longer than the fourth: pronotum with the posterior angles prominent and nearly rectangular; sides in front serrated: scutellum attenuated, rounded at the tip, with some black speckles along each side near the base: abdomen with the hind angles of the apical segment extending beyond the anal appendage: hemelytra more minutely punctured than the pronotum: membrane pellucid (*Walker*). Long,  $12\frac{1}{2}$  mill.

Reported from India. Differs from *M. truncatus*, Westw., in having the posterior angles of the pronotum more determinate and the thorax more abruptly contracted.

IV.—*On certain Earthworms from the Western Himalayas and Dehra Dun.*—By ALFRED GIBBS BOURNE, D.Sc. (Lond.), C.M.Z.S., F.L.S., Fellow of University College, London, and Madras University. Communicated by THE SUPERINTENDENT OF THE INDIAN MUSEUM.

[Received December 15th, 1888;—Read January 2nd, 1889.]

(With Plate III.)

*Introduction.*—These specimens were collected and placed in my hands for examination by Mr. J. Wood-Mason, Superintendent of the Indian Museum, Calcutta. They come from two localities, Dehra Dun and Masouri. Dehra Dun lies at the foot of the Western Himalayas and at no great elevation. Masouri lies at an elevation of 5—6000 feet on the southern slopes of the Western Himalayas.

The worms from Dehra Dun belong to the three genera *Perichæta*, *Perionyx*, and *Typhæus*. There is one species of each of these genera. The *Perichæta* is *P. houlleti*, E. Perrier. The specimens of *Perionyx* are none of them in a sufficiently mature condition to enable me to characterize the species; they differ in the shape of the setæ and in colour from *P. saltans*, Bourne; neither can they be referred to *P. excavatus*, E. Perrier; nor to *P. m'intoshi*, Beddard. The *Typhæus* I have referred to a new species, *T. masoni*. The worms from Masouri include three species of *Lumbricus*, or at any rate of some genus or genera of the *Lumbricidæ*, and two species of *Perionyx*. The specimens of the latter are, like the specimens of *Perionyx* from Dehra Dun, immature, and do not moreover appear to belong to any of the hitherto described species of this genus. I refrain from naming the species of *Lumbricus*, because I could only give an incomplete description and thus hamper any future observer who obtains them in a fresh condition. The literature with regard to the genera and species of the *Lumbricidæ* is already in great confusion. I am now acquainted with seven distinct species belonging to this family which occur in India.

We have not at present many data with respect to the relation between the altitude and the worm fauna.

I have stated\* that *Perichæta stuarti* is to be found at an elevation, of 5000 ft. and also at one of 1000 ft., but this has proved to be a mistake which arose from my collector having mixed specimens from the two localities. I cannot find *P. stuarti* at any great distance down the ghaut.

\* On Indian Earthworms, Part I. Preliminary Notice of Earthworms from the Nilgiris and Shevaroyas. Proc. Zool. Soc. 1886, p. 667.

Fletcher\* has recorded specimens of the same species of worm from different altitudes, e. g., *Lumbricus novæ-hollandiæ* from the sea-level at Sydney and from 2,700 ft. at Capertee; *Perichæta exigua* from the sea-level near Sydney and from Springwood on the Blue Mountains.

There is, I presume, nothing like the difference in climate between these Australian localities that exists between that of any hill-station in India and of the plains. So far as my observations go all the species from hill-stations differ from those of the plains. I have found species of *Perichæta*, *Acanthodrilus*, and *Mouligaster* on the hills and other species in the plains, but I have never found *Lumbricus* in the plains. I do not know how far the present collection is an exhaustive one from the district, but so far it appears that *Typhæus* is confined to the plains or moderate elevations, while there is an undoubted *Perionyx* from Dehra Dun, and of the three species of *Perionyx* previously described *P. saltans* comes only from considerable elevations, *P. excavatus* and *P. m'intoshii* come presumably from the plains, so that the genus *Perionyx* is also to be found at varying elevations.

None of the species in the present collection are identical with any which I have hitherto found in Southern India.

#### PERICHÆTA HOULETI.

I do not propose to give any lengthy account of this worm without examining it in a fresh state. It is the less necessary to do so as the existing accounts enable one to recognise it with great certainty. It was originally described by Perrier,† and Beddard subsequently published two notes upon the species.

In one‡ of these he has described the setæ which are placed on the clitellar somites as much smaller than the setæ of the "anterior pre-clitellar" somites, and states that they terminate in a "distinctly bifid extremity; the two points in which the seta ends diverge at a considerable angle from each other, but are connected by a delicate membrane. The opposite extremity of the seta, which is imbedded in the body wall, is abruptly truncated. The whole seta has not the S-shaped curve, which is so constant a character in the group, but is curved only in one direction. As in the other setæ of the same species, and in the setæ of earthworms generally, the middle part is somewhat thicker; but this region does not lie in the middle of the

\* Notes on Australian Earthworms. Proc. Linn. Soc. N. S. W. 1886, p. 545; 1887, p. 387.

† E. Perrier, Recherches pour servir à l'Histoire des Lombriciens Terrestres, Nouv. Arch. d. Mus. t. viii, 1872.

‡ Proc. Zool. Soc. 1887, p. 380.

setæ, but is closely approximated to the posterior extremity; the part of the seta which lies behind the dilated region is straight. The general shape of these clitellar setæ, apart, of course, from the bifid extremity, is like that of imperfectly developed ordinary setæ. That this is not really the case with these setæ is, however, clearly shown by the fact that all the setæ of the several rows comprised in the clitellum have precisely the same shape, and also by the fact that in two specimens of the worm, which were the first that came to hand, the structure of these clitellar setæ was precisely identical."

The ordinary setæ present also some variations in size. The seta immediately on either side of the median ventral line is usually if not always larger than the others. The setæ on the clitellar somites in my specimens agree with the minute description quoted above.

Perrier states that the gizzard occupies somite IX, but I have found that the septa separating somites VIII—IX and IX—X are absent, so that the gizzard may be said to occupy somites VIII, IX, X. This is the position ascribed to the gizzard in *P. fea*, *P. indica*, *P. peregrina*, and is moreover its probable position in *P. sieboldi*, *P. japonica*, *P. musica*, and *P. annulata*. These are all worms possessing other special characters in common, and further investigation will probably add to the list *P. affinis*, *P. birmanica*, *P. sumatrana*, *P. hasselti*, *P. robusta*, *P. aspergillum*, *P. quadragenaria*, *P. elongata*, *P. schmurde*, *P. capensis*, and, possibly, *P. queenslandica* and *P. darnleyensis*.

The organs described by Perrier as testes are doubtless seminal reservoirs; in position and structure they agree with these organs in so many other worms. I have not, however, been able to find the true testes, but could doubtless do so in fresh specimens. The spermathecae and prostates have been described and figured by Perrier. I have figured them in Pl. III, Figs. 4 and 5. The number, position, and structure of the spermathecae have been largely used as specific characters. The structure of the prostate glands is a character of no less specific importance.

#### TYPHÆUS MASONI, sp. n.

*External characters.*—Length 130 m.m.; width 6 m.m. Prostomium is short and broad and can be retracted so as to be hidden by the first or buccal somite. The latter is but very slightly marked off from the second somite and is as usual devoid of setæ. The other pre-clitellar somites consist of two, three, or even four annuli.

The clitellum when fully developed extends completely round the body in somites XIV, XV, XVI, nearly the whole of XVII, and a small portion of XIII.



The clitellum presents ventrally a very curious appearance owing to the structures about to be described. Between somites XV and XVI, and also between somites XVI and XVII, there is a pair of oval depressions in the middle of each of which stands a little papilla. Between somites XIX and XX there are similar structures, but the depressions are much less marked and the whole thing is smaller. These structures are a very little further from the ventral median line than are the ventral pair of setæ on each side. The male pores are placed in somite XVII a little further still from the median ventral line; they are on papillæ which lie in very deep pits. These structures are shewn in Pl. III, Fig. 1.

The oviducal pores are placed anteriorly to the setæ in somite XIV; they are separated from one another.

The spermathecal pores are very well marked slit-like apertures placed between somites VII and VIII; they lie nearer the middle line than do setæ 3.\* The dorsal pores, intersomically placed, are visible behind the clitellum; they are especially well marked at the posterior end of the body.

Nephridiopores are not visible. There are eight setæ in each somite; they are confined to the ventral surface of the body. Their arrangement in eight longitudinal rows is what chiefly strikes one on examining a spirit specimen. In about the anterior two-thirds of the body setæ 1 and 2, and 3 and 4, lie nearer to one another than do setæ 2 and 3, that is to say, the setæ are placed in couples, but this arrangement gradually changes and in about the posterior third of the body the eight setæ still lying in a row on the ventral surface are almost equidistant from one another. The ventral gap remains however a trifle wider than the interspace between any two setæ.

The full complement of setæ is present in the clitellum, but in somite XVII setæ 1 and 2 are replaced by the groups of penial setæ described below.

*Septa.*—The most anterior septum is septum IV—V (*i. e.*, the septum which forms the boundary between somite IV and somite V). This and septum V—VI are very thick being exceedingly muscular. The next septa which are developed are, I think, septa VIII—IX, IX—X, and X—XI. These are all fairly muscular and placed close together, that is to say, they do not correspond in position with the external divisions between the somites. It is therefore exceedingly difficult to

\* I adopt the convenient system of numbering the setæ suggested by Benham, seta 1 being the seta which lies nearest the median ventral line on either side; seta 2 the seta immediately beyond seta 1 and so on.

state with certainty which segments they really bound. All the remaining septa are very thin.

*Alimentary Canal.*—The mouth occupies the usual position and when the prostomium is protruded is overhung by it, but, as stated above, the prostomium can be retracted so as to be completely hidden by the buccal somite; the mouth then appears to be terminal.

The buccal cavity and pharynx resemble those of *T. orientalis*.

The gizzard has precisely the structure described for that species. It is "divided into two portions an anterior small thin-walled compartment and a large thick-walled portion, the gizzard proper, this last has a nacreous appearance on the outside and is lined by a very thick chitinous layer." It lies between septum V—VI and septum VIII—IX and thus extends over three somites (VI, VII, VIII). Muscular bands are attached to the walls of the gizzard and pass to the body wall.

The alimentary canal is considerably dilated in somite XI or XII, a pair of œsophageal glands being present. From the gizzard up to this dilation the œsophagus is narrow, and beyond the latter, until it widens out at about somite XVI, it is also narrow.

There are four pairs of glandular bodies placed on the intestine in the hinder region of the body. They are all bi-lobed and lie below the dorsal vessel and not above it. (Beddard states that they lie above the dorsal vessel in *T. orientalis*.)

*Nephridia.*—There are large tufts of nephridial tubules in the pharyngeal region and a series of smaller tufts in the other pre-clitellar somites. I have especially noted the tufts which are placed near the spermathecal ducts. I am unable, from the specimens I have, to enter into further details with regard to the nephridia, but I have observed nothing which differs from Beddard's account of these organs in *T. orientalis* and *T. ganimi*.

*Generative organs.*—I am anxious to examine other specimens before giving a full account of these organs.

A pair of ovaries are present in the usual position in, I believe, somite XIII, but the specimens being very contracted in this region it is impossible to be quite certain as to the number of any particular somite. The oviducts open to the exterior by a pair of pores placed in the anterior half of somite XIV.

I have been unable to see the testes.

I have found a single pair only of seminal reservoirs and near them a pair of bodies with a nacreous appearance which seem to be ciliated rosettes, as, connected with these, I find the vasa deferentia.

I cannot be quite certain, but apparently both the seminal reservoirs and the ciliated rosettes belong to somite XI; as mentioned above, the

septum which I have calculated to be septum X—XI is a thick one, and they certainly lie posterior to it. The seminal reservoirs are very large and extend backwards over three or four somites.

The prostates (I reserve for the present any expression of opinion as to the desirability of retaining this term or substituting for it the term atria) are large and lie one on either side of the body. Each consists of an irregularly coiled, almost orange-coloured, glandular tube which is connected at one end with a muscular duct opening to the exterior in somite XVII. The vas deferens is connected with this just before it penetrates the body wall. There is a muscular sac containing several very long and slender penial setae, these project from the little papilla which lies in the depression round the male pore. These setae are shewn in Pl. III, Fig. 3. There are two varieties, one of which is nearly a quarter of an inch in length and much longer than the other.

There is a single pair of spermathecae, the apertures of which lie between somites VII and VIII, as shown in Pl. II, Fig. 1. Each spermatheca is large, somewhat reniform in shape, and has arising from the hilus a short, very stout and muscular efferent duct. Opening into the duct near the hilus is a pair of diverticula. One of these is so deeply bi-lobed as to almost form two separate little sacs, while the other is slightly tri-lobed. Both have a very nacreous appearance which is not possessed by the spermatheca itself.

*General Remarks.*—There can be no doubt but that this worm belongs to the genus *Typhorus*, Beddard. Two species of this genus have been described, *T. orientalis*\* and *T. gammi*.†

I should have hesitated about placing this worm without further information in a separate species had not Beddard described this second species *T. gammi*; but this worm differs as much from either *T. orientalis* or *T. gammi* as these latter do from one another. Beddard denies the existence of a prostomium. If this is non-existent it is a very remarkable fact. Beddard states that setae 3 and 4 are absent from the somites which form the clitellum in *T. orientalis*. He does not mention their presence or absence in speaking of *T. gammi*. They are present in my species, although not always visible on a mere external examination. Beddard says nothing with regard to the arrangement of the setae in the posterior region of the body, so that I am justified in concluding that the arrangement which I have noted is peculiar to my species; it gives the worm such a striking appearance that one could hardly fail to notice it. Beddard does not mention oesophageal glands as present in either *T. orientalis* or *T. gammi*.

\* Beddard, Ann. & Mag. Nat. Hist. ser. 4, vol. xii, 1888.

† Beddard, Quarterly Journ. Microsc. Science, vol. xix, 1888.

There is still some doubt, I think, with regard to the position of the septa in all species, and, until this is resolved, it is difficult to fix the position of the testes, seminal reservoirs, and ciliated rosettes. Beddard states that in *T. gammi* the two most anterior septa are septa IV—V and V—VI; that one septum, presumably VI—VII, is absent and that "farther back are three thickened septa which lie between segments VIII, IX and X." Now, I believe, that in ascribing a position to the internal organs we should determine the somite by the septa which bound it. It is true that the septum often appears to have a position which is not in accordance with the limits of the somites as marked externally, but this may be seen in longitudinal sections to be due to the fact that the muscular fibres of the septum adhere for some little distance, either backwards or forwards, to the body wall. Beddard's statement that three septa lie between three "segments" is misleading. Three septa bound two somites. I would interpret the "three thickened septa" mentioned above as septa VIII—IX, IX—X, and X—XI. If this be the case the single pair of testes and ciliated rosettes lie in somite XI. According to Beddard's account of *T. gammi* they lie in somite X, while judging from his figure they would appear to be in somite XII.

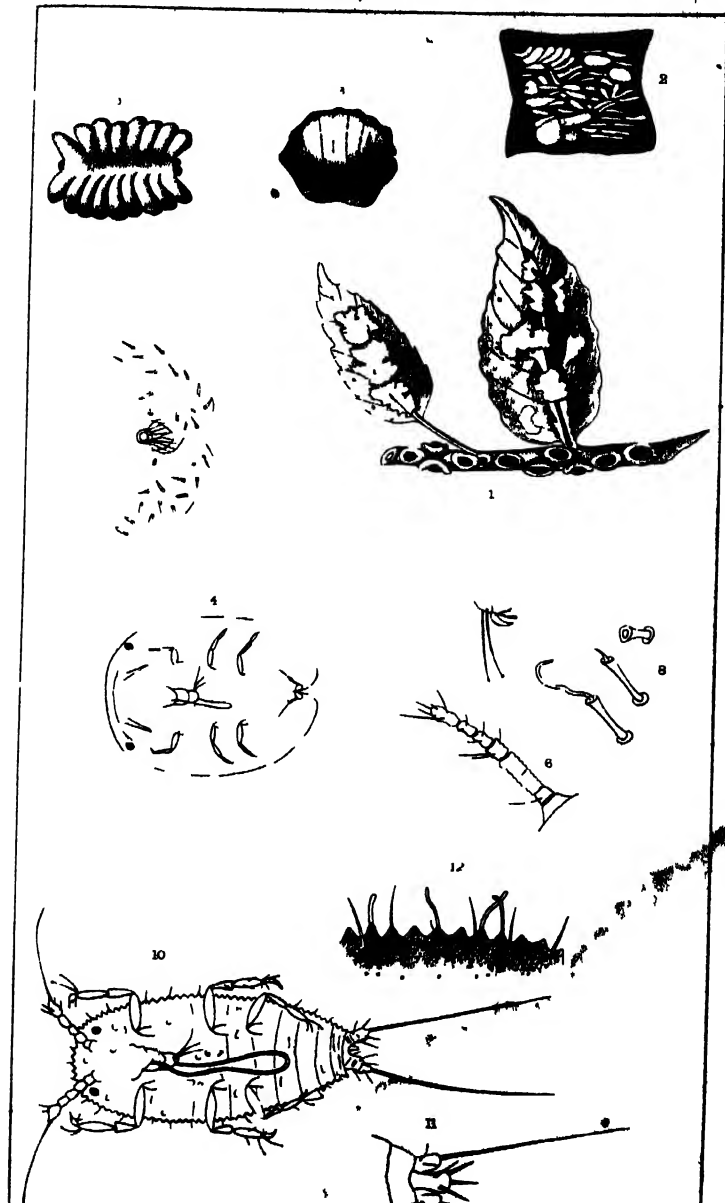
I propose to define the present species as follows:—

*T. masoni*.—Penial setæ of two varieties lying together in the same sac; the one variety very long, with a slight S-shaped curve and a sub-terminal dilation at the distal extremity, while the proximal extremity presents irregular transverse markings; the other variety shorter, somewhat spear-shaped, the distal extremity flattened and furnished with obscurely marked chevron-shaped ridges.

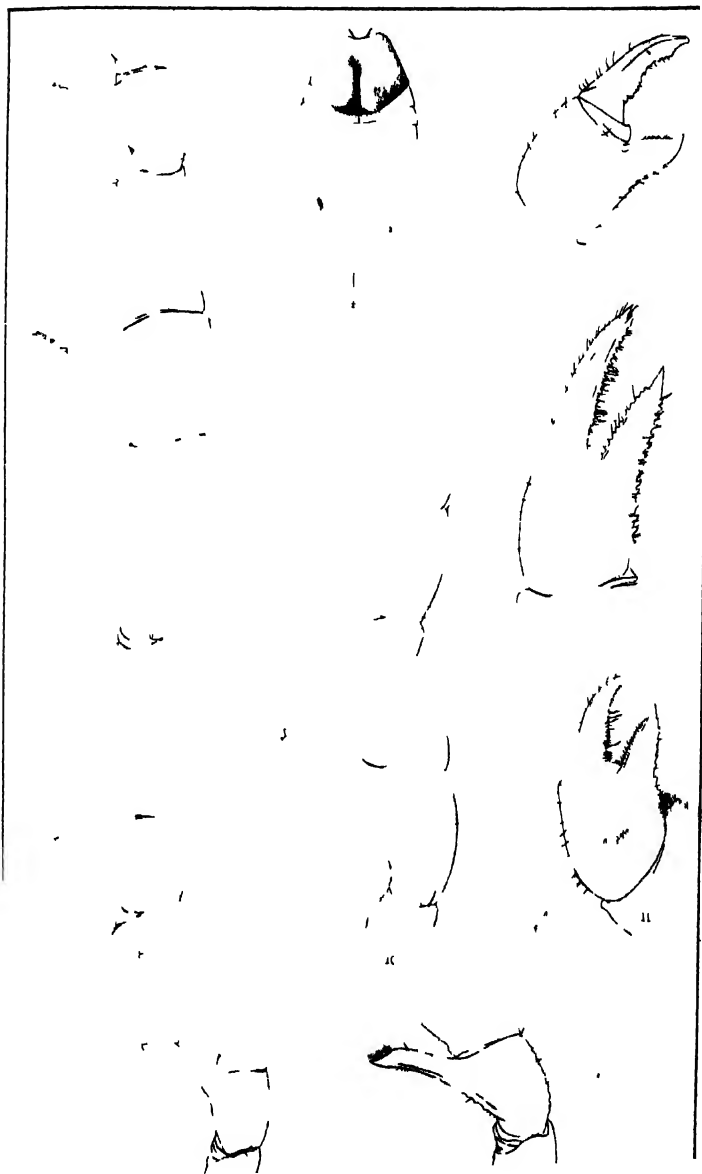
The setæ in about the posterior third of the body are not arranged in couples as in the anterior two-thirds, but are equi-distant from one another, the ventral gap being slightly larger than the interspace between any two setæ.

The spermathecae are provided with two diverticula, the one bifid the other obscurely trifid.

I do not suggest any modifications of Beddard's definition of the genus, but expect that some will be ultimately necessary. As far as we know, neither the character of the diverticula of the spermathecae nor the number of these organs themselves is of generic value. The number of intestinal glands probably varies in different species, and, further, I am not quite sure about the position of the testes.

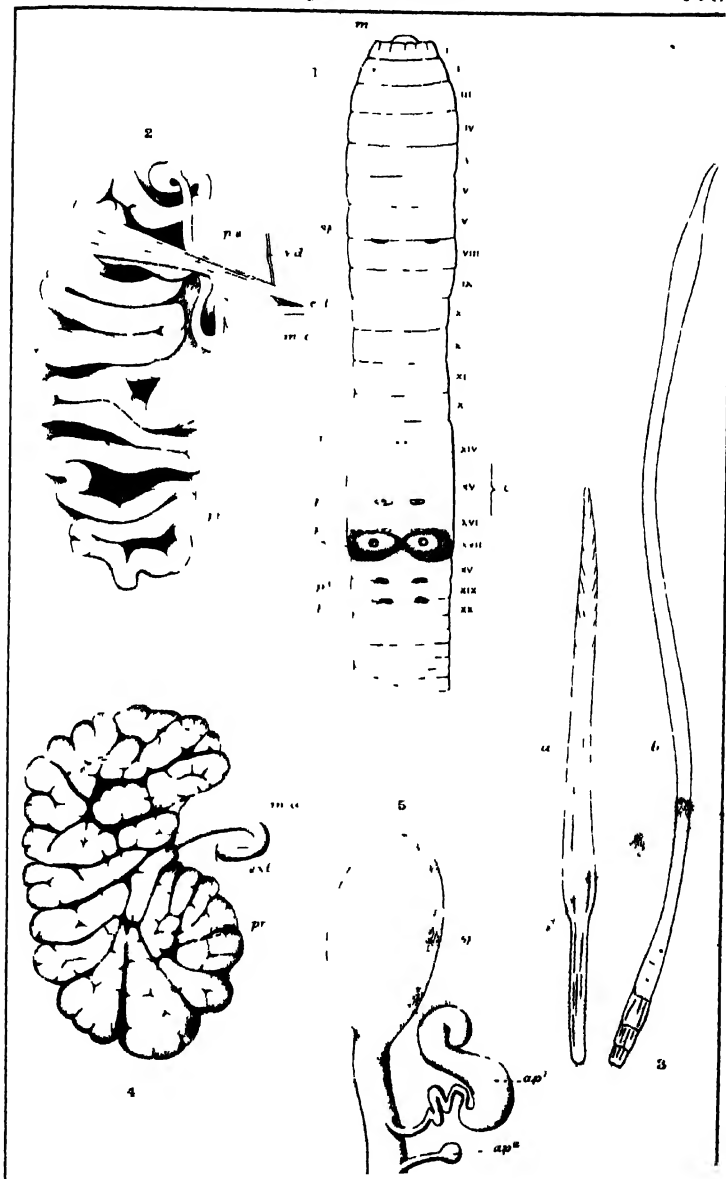














NEW SERIES

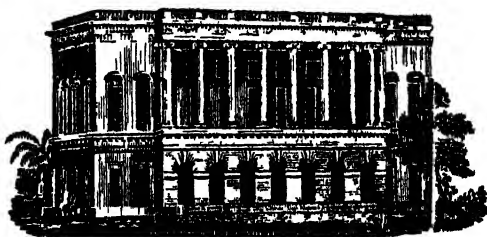
VOL. LXIV.

GOVERNMENT.

JOURNAL  
OF THE  
ASIATIC SOCIETY OF BENGAL,  
Vol LXIV Part II, No 1,—1895.

EDITED BY

THE NATURAL HISTORY SECRETARY.



"The bounds of its investigation will be the geographical limits of Asia, and within these limits its inquiries will be extended to whatever is performed by man or produced by nature"—SIR WILLIAM JONES

\* \* \* Communications should be sent under cover to the Secretaries, Asiat. Soc., to whom all orders for the work are to be addressed in India; or care of Messrs. Lucas & Co, 46 Great Russell Street London, W. C, or Mr. Otto Harrassowitz Leipzig Germany

~~~~~  
CALCUTTA.

PRINTED AT THE BAPTIST MISSION PRESS,
AND PUBLISHED BY THE
ASIATIC SOCIETY, 57, PARK STREET

1895.

CONTENTS.

	Page
<i>Natural History Notes from H M Indian Marine Survey Steamer 'Investigator,' Commander C F. OLDHAM, R. N., commanding—</i>	
Series II, No. 18—1 <i>The Topography of the Arabian Sea in the Neighbourhood of the Laccadives 11 The Physical Features of some of the Laccadive Islands, with Suggestions as to their Mode of Formation—By Commander C. F. OLDHAM, R. N. (With Plates I and II)</i>	1
2 <i>On a new species of Flying Lizard from Assam—By A. ALCOCK, M.B., C.M.Z.S., Superintendent of the Indian Museum. (With Plate III)</i>	14
<i>Materials for a Flora of the Malayan Peninsula—By GEORGE KING, M.B., LL.D., F.R.S., C.I.E., Superintendent of the Royal Botanic Garden, Calcutta</i>	16
3 <i>Description of a New Lathraea from the Eastern Himalaya—By SURGEON-CAPTAIN H. A. CUMMINS, Army Medical Staff ...</i>	137

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.



Vol. LXIV. Part II.—NATURAL SCIENCE.

No. I.—1893.

- * *Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding. Series II. No. 18.*—i. *The Topography of the Arabian Sea in the Neighbourhood of the Laccadives.* vi. *The Physical Features of some of the Laccadive Islands, with Suggestions as to their Mode of Formation.*—By Commander C. F. OLDHAM, R. N.

With Plates I & II.

[Received 15th September.—Read 7th November.]

i *Topography of the Arabian Sea in the Neighbourhood of the Laccadives.*

SECTIONS AND TEMPERATURES.

Only in recent years has any exploration been made of the bottom of the ocean in Indian Seas, beyond the hundred-fathom line.

Before 1881, the hundred-fathom line, on the West Coast of Hindustan, was well sounded out by the officers of the Indian Navy, but no attempt had been made to define its limits in either the Bay of Bengal or Gulf of Martaban. Since 1881, the officers of the R. I. M. S. "Investigator" have yearly been employed, during the fine season, in surveying the coasts, sounding out to deep water, and taking deep sea soundings and temperatures when making passages to and from the surveying ground. From the soundings and temperatures obtained in the Bay of Bengal, Commander A. Carpenter, in 1887, was enabled to write a paper

* Communicated by the Natural History Secretary.

on "The Mean Temperature of the Deep Waters of the Bay of Bengal."* Since then, owing to the survey of the Laccadives and the frequent passage of the "Investigator" past this group, a large number of deep soundings and temperatures have been accumulated in the Laccadive area. Advantage is now taken of these soundings to draw a chart shewing the contours in this region (see Plate I).

In the latitude of Bombay the hundred-fathom line is distant about one hundred and twenty miles, the soundings deepen seaward from the coast gradually, forming a shelf, which narrows on proceeding southward, until in the latitude of Cape Comorin it is only thirty miles broad.

The general slope seaward, beyond the hundred-fathom line, is from two to three degrees: it is broken occasionally by ridges or spurs of comparatively shoal water, and in latitude 11° N a ridge, on which are situated the Elicapeni Reef and Androth Island, projects for fifty miles to the south-west. In the Laccadive area the eleven hundred fathom line encircles the whole group, connecting the reefs at this depth with the neighbouring slope from the coast of Hindustan. Two tongues of deeper water narrow the connection with the slope from the coast, and an extensive tract of depths over eleven hundred fathoms occupies a position east of the Laccadives, on a line between the tongues.

The western islands and reefs are all situated on an extensive plateau of under a thousand fathoms, and are separated from the eastern by a narrow flat, averaging a thousand and twenty fathoms. The most northern of the group is a submerged reef, situated on the eastern side of a plateau of under nine hundred fathoms; the next two are also submerged reefs, rising from a similar plateau; south of these are three lagoon reefs, likewise connected by depths under nine hundred fathoms; and still further south are two groups each containing two reefs, and three isolated reefs, all rising from similar depths. The eastern reefs consist of three, namely, the two northern, situated on the ridge already mentioned as jutting out from the coast slope, and another island rising abruptly from depths of eleven hundred fathoms.

Minikoi, in latitude $8^{\circ} 15' N.$, sometimes spoken of as being one of the Laccadives, is separated from that group by depths of over twelve hundred fathoms, but has a submarine connection with the *Maldives* to the southward.

The outer slope from the plateau on which the islands are mostly situated is gradual, until the floor of the ocean is reached in depths a little over two thousand fathoms.

Soundings and temperatures obtained during the months of October

although in different years—the thermometers used being the Miller-Casella pattern, constructed by Cary of London; and the observations being corrected for the errors supplied from Kew Observatory—show that the waters of the eastern part of the Laccadives, in depths over six hundred fathoms, are considerably warmer than the waters towards the Hindustan coast, and than those to the westward of the Laccadives.

On the plateau a temperature of 41° F. is reached at a depth of 905 fathoms, while the same temperature is met with at 790 fathoms on the thousand fathom line near the coast.

The bottom temperatures on the western side appear somewhat erratic, but with one exception they all tend to shew a higher temperature over the plateau than on either side. The surface temperatures vary from 77° F. to 83° F., the highest temperature being in the neighbourhood of the reefs.

The isothermal lines vary in depth to 400 fathoms, after which they are even to 600 fathoms, from 700 until the bottom is reached they dip downward in the centre owing to the warmer waters over the Laccadives.

A curve shewing the mean temperature at different depths from the surface to 1,800 fathoms, is shewn in black at Plate II. From the surface to 100 fathoms the curve depends on one series of observations taken every 25 fathoms; from 100 to 400 fathoms, it depends on twelve observations at varying depths, and from 400 to 1,800 fathoms, the curve is the mean result of fifty-six observations; all these observations were taken in the months of October, November, and April, at the change of the monsoons. The curve shewn in red on the same figure is taken from Commander Carpenter's paper on the mean temperature of the deep waters of the Bay of Bengal. It is derived from observations taken during the fine season—November to May.

The Arabian Sea curve to 100 fathoms depends on so few observations that it is not desirable, up to this depth, to make any comparison with the Bay of Bengal curve. Beyond 100 fathoms, where the observations are numerous, it will be noted that there is a difference of about one to two degrees; the Arabian Sea on the west coast of Hindustan in October, November, and April, being that amount warmer than the Bay of Bengal. At a depth of 1,800 fathoms the two curves coincide.

Sections of some of the Laccadive islands and reefs—the direction of the sections taken being generally at right angles to the length of the islands—show that the under-water slopes vary from 10 to 37° degrees, and that the slopes of the lagoon islands are rather steeper than that of reefs, at *Betra Par* and *Peremul Par*. At *Kardamat* the bottom

slopes 19 degrees each side: *Kiltan* has a slope of 23 degrees on the west side and 27 to 10 degrees on the east: *Ohillac* has the steepest slope on the east side, namely, 27 to 10 degrees, and 13 degrees on the west.

The sections of *Kavaratti* and *Agatti* are very similar, they have both a slope of 13 degrees on their west sides, and a more gradual declivity on the east sides.

In *Peremul Par* and *Betra Par*, which are lagoon reefs, the slopes vary from 14 to 16 degrees in the former, and 10 to 20 degrees in the latter.

From the above it will be seen that the narrowest atolls, viz., *Kardamat*, *Kiltan*, and *Ohillac* have the steepest slopes.

The under-water slopes beyond the two-hundred-fathom line would appear to depend principally on the shape of the peak on which the atolls are situated.

ii. *The Physical Features of some of the Laccadive Islands, with Suggestions as to their Mode of Formation.*

The Laccadives (see Plate I), a group of coral atolls and reefs, lying from one hundred and twenty to two hundred miles from the West Coast of Hindustan, extend from Latitude 10° N. to 14° N., and Longitude $71^{\circ} 30'$ E to 74° E.

This area contains four submerged coral reefs, six coral reefs with sand cays, or small uninhabited islets, and eight inhabited atolls. Five of the atolls and three of the reefs were examined during the visits of the "Investigator" in October and November 1892-93-94; and are described in the following notes:—

Kiltán Island is two miles long N. N.-W., and S. S.-E., and a quarter of a mile broad, having a shallow lagoon on its side. The highest part of the island, which is about 25 feet above high water-mark, lies on the eastern side: from here there is a general slope downwards to the lagoon, its north and south extremes curving slightly to the westward. In places, ridges of coral and coral-sand stretch along in the direction of its length, breaking the general slope lagoonwards.

The island is formed of coral sand, coral sand rock, and broken fragments of coral reef rock, overlying a hard conglomerate composed of fragments of reef corals. The coral-sand rock may be seen exposed on the lagoon beach of most of the Laccadive islands; it is of a friable nature, but its surface becomes very hard when exposed to the air. Most of the houses are built of blocks of this stone, which are cemented together with *chunam*. Good water is obtained by sinking wells until the conglomerate reef rock is reached.

On the eastern shore the beach is composed of broken boulders of reef corals and comminuted fragments. On this side the reef extends a hundred yards from the beach, and then goes off into deep water; the reef does not dry, and a boat in fine weather can always pass over it and ground on the beach off the ends of the island; shallow water of 5 to 7 fathoms extends over half-a-mile. The lagoon appears to be 6 to 8 feet deep, and has two openings to it through the reef. These openings would soon close by the growth of the coral did not the natives periodically clear the passages.

The island appears to be extending lagoonwards, by the accumulation of coral sand washed from the reef; its extremes are also being added to by the sand and *débris* washed up by the currents. Its surface is thickly planted with coconuts, jungle being found only on the extremities and where the island has extended lagoonwards.

Mention has already been made of the reef on the eastern side of the island; that on the western side is different in character, being a reef a-wash at low water, which extending from the extremes of the island, encloses the shallow lagoon. Owing to the weather no examination was possible, but viewed from seaward it appeared to be formed of coral in vigorous growth: the soundings obtained shewed a gradually increasing depth from the reef to the 20-fathom line, where it drops into deep water.

Chittac Island extends N. N.-E. and S. S.-W. $1\frac{1}{2}$ miles, and is about one-third of a mile broad. Like Kiltán it forms the eastern side of a coral atoll. Ridges and mounds of sand and coral were observed in different parts, highest mound being about 30 feet above high water. On the eastern side, inside the beach, is a long narrow depression. The eastern beach is covered with big boulders of reef corals. The fringe reef extends 20 to 30 yards from the beach, uncovers at low water, and has growing coral at its edge; its surface being strewn with coral *débris*.

The north point of the island extends about 200 yards beyond the coconut plantation, and curves towards the lagoon; the first 100 yards of this extension is covered with littoral plants, the last part with large boulders of coral broken off the fringe-reef, which here is very narrow. Sand has been washed up and has accumulated amongst the boulders.

The north point of the island has altered in appearance since the last survey in 1848. At that time, an island existed off the north end, which at present is connected to the main, and covered with bushes. The natives report that the connection was made in November, 1891, during a storm from the N.-E.

The reef enclosing the lagoon has two openings through it, that to the northward being broad and shallow with numerous patches of growing coral. An examination with a water-glass shewed that, off the eastern and southern sides, coral was growing in 5 to 7 fathoms, and everywhere off the western side of the atoll it appeared to be growing luxuriantly. An attempt was made to collect some, but owing to defective means none was obtained; the grapnel sent down, after catching several times and bringing nothing up, eventually caught a large mass of madrepore, and was lost.

Inside the lagoon, and in the northern entrance, numerous patches of *Porites*, Madrepore, and blue coral were growing, except towards the south end where the bottom is principally coral sand. The absence of live coral towards the south end is no doubt due to the reef here being almost continuous, preventing the current and tides from supplying food, and the coral being killed by the accumulation of sand washed from the reef. In all parts where the tide ebbed and flowed live coral was observed.

Good water is obtainable on the island, and as in Kiltán, is no doubt the drainage from the soil resting on the conglomerate coral rock.

I found several pieces of volcanic rock, and a green stone on the north end of the island; they were said by the natives to have been brought from Byramgore Reef, where a steamer, with stone ballast had been wrecked.

Kardamat Island extends $4\frac{1}{2}$ miles N. N.-E. and S. S.-W., with an average width of about a quarter of a mile. Like Kiltán and Chitlac it is situated on the eastern side of an atoll, and forms about one-third the circumference. The centre of the island, and oldest part, is well covered with coconuts. It seems to be formed principally of blown sand overlying coral-sand rock. The latter can be observed in many places on the lagoon edge; where it is exposed between high and low water, it generally dips at a slight angle towards the lagoon.

The extremes of the island carry a scanty vegetation of jungle 6 to 8 feet high, but attempts are being made to grow coconuts over the whole island.

The northern point of the island is formed by a spit of sand on which I found a quantity of pumice, extending inland for about fifty yards from the extreme point; it is strewn all over the surface, and varies in size from a marble to half a foot in diameter.

Although there is a large quantity on the point, it is not more than is frequently found washed up on coral islands in other parts of the world, where, as is the case at Kardamat, the currents are favourable

for collecting and washing up whatever may be floating in the neighbouring seas.

This pumice was first noticed by the surveying officers during their visit in the autumn of 1892, and is mentioned by Dr. Alcock in his Administration Report for that year.

The south extreme of the island is a sandy point along which vegetation is gradually creeping as the point extends.

The fringe-reef which fronts the eastern edge of the island is narrow, and has growing coral on its edge, only the surface of the reef being encrusted with Nullipore, or cemented into a reef flat.

The remaining part of the atoll, not occupied by the island, is a coral reef, awash at low water, the only openings being to the N.-E., and very narrow. In consequence, there is very little live coral within the lagoon, the most notable patches being in the neighbourhood of the entrance and towards the western side, opposite the centre of the island. The lagoon is from 2 to 6 feet deep.

The soundings shew that the bottom slopes steeply on both the east and west sides of the atoll, from about 20 fathoms into deep water, but towards the N N-E and S S.-W, the direction in which the atoll soundings shew a much more moderate slope, there is a depth of 272 fathoms at two-and-a-half miles from the north point, compared to 500 fathoms at one-and-a-quarter mile from the east side, and 730 fathoms at one-and-three-quarters mile from the west side of the atoll.

Betra Par. This is an atoll six miles north and south, and three miles broad, with an islet on its north-east end, and two sand cays joined by patches of sand, on its eastern side. The islet is nothing but a sand cay, covered with coconuts, extending nearly half-a-mile along the reef. Its inner side, which is washed by the waters of the lagoon, is probably the oldest part, as it carries the tallest coconuts; here the sea is encroaching, the roots of the trees are exposed, and several have fallen. The north-east side of the islet is formed by a shallow bay in which are several slabs of coral-sand rock, which jutting out beyond the line of the beach shew that that part of the beach has been washed away. The extremities of the island are increasing in the direction of its greatest length.

The encircling reef dries nearly everywhere at its edge at low water springs; it is broadest on the eastern and southern sides, and has only one opening through it, just south of the islet.

I examined the northern and western sides of the reef, and the other surveying officers visited the other portions. The middle of the western side is about 250 yards broad, and on the extreme western

part is an iron band boiler which must have been part of a wreck ; it is embedded about one foot and lies completely on the reef, so that at low water I was able to walk round it. Two clumps of coral about one foot in diameter were growing on its outside, and several smaller inside.

The reef here dries about one foot at low water and is covered with live coral. Of the latter the branching Madreporae were the most common, but a *Porites* and Brain-coral were also numerous.

The north side of the reef is the narrowest ; it dries 3 feet at low water, is about 100 yards broad, and is composed of piled up coral, broken off the growing edge.

Inside the lagoon the average depth is from 3 to 4 fathoms. Here are numerous coral clumps awash or dry at low water. I examined two of them and found that coral was growing on the sides, but the top was dead, and covered with Nullipore.

Inside the reef, from the islet round the western side to the sand cays on the south side, is a remarkable broad shelf with about half a fathom water over it, formed of dead coral and sand, the coral being in a state of decomposition.

This shelf is about half a mile broad on the north-west part, increasing as the width of the growing reef increases, and reaching a width of one mile to the southward. On its inner side it drops suddenly into the general depths of the lagoon which I have already mentioned as being from 3 to 4 fathoms.

I think that this shelf may be accounted for on the supposition that the coral reef commenced to grow at the inner edge of the shelf, and has worked seaward, leaving behind it a reef-flat, which is kept at its present level by sand and *debris* being washed in from the outer edge, and by the solvent action of the sea-water. The eastern side of the atoll, not being so favourably situated as regards the currents and tides, has not grown seaward sufficiently and rapidly to leave a reef-flat behind ; it is here also that sand and *debris* collect which would also assist in retarding the growth of the coral.

The soundings shew a fairly corresponding slope on all sides, from the edge of the reef out into deep water.

Peri Mul Par. This reef, which only dries at low-water springs, is somewhat crescent shaped, the concave side being open to the northwest. Its longest diameter is seven miles, and its width four miles. The edge of the reef shews at low water, but at high water and in smooth weather it is difficult to distinguish, and in many places does not break. The encircling reef is very narrow, and I am informed by the officers who examined it that it is only growing at the outer edge.

Inside the reef, and extending towards the centre for about one mile, all round the south west and north sides, is a shallow flat or shelf with depths over it of under one fathom. It consists of sand and broken coral, and seems, as in Betra Par, to be formed by the seaward growth of the reef and the dissolving action of the sea-water. Inside this reef-flat the depths are from 3 to 6 fathoms, the centre part containing ridges of coral which run N. N.-W. and S. S.-E.; towards the N.-E. side there are fewer coral-heads, and here are several good boat entrances.

At the N.-E. corner of the atoll is a small sand cay with coral boulders piled up on its eastern side. Patches of sand, which shew at low water, are also found on the eastern side of the atoll.

From the appearance of the reef, the reef-flat, and the soundings, it is evident that the reef is growing westward and southward at a greater rate than in other directions.

Kavaratti. Like the other eastern atolls of the group, consists of an island, with a coral reef on its western side enclosing a shallow lagoon. The island is $2\frac{1}{2}$ miles long N.-E. and S.-E., and three-quarters of a mile broad towards its north end, narrowing to about a cable half a mile from its south extreme. The coral reef forming the lagoon runs parallel to and is about six cables from, the beach, it is awash at high water near the north end, but covers nearly half a fathom about the centre.

On the lagoon side the island has sand hillocks 15 to 20 feet high, lining the beach for about half the length of the island from the N.-W. extreme; in the centre of the island is a fairly level area, the land sloping up gently as the eastern beach is approached.

The beach on the N.-E. side is strewn with large coral boulders; the eastern beach is exceedingly steep, with a narrow fringe reef. The natives of this island seemed better off than in most of the Laccadive islands; they own several large boats which trade with Cochin.

A comparatively wealthy and intelligent native who had lived here all his life was questioned as to changes that had occurred in the configuration of the island. According to him the most frequent gales are from the south west, when large quantities of sand are blown up and deposited on the western side of the island, only to be washed away by the currents and winds of the other season. Good water is obtained from wells about 10 to 12 feet deep, formed by cutting through a thin stratum of coral rock below which the fresh water seems to lodge.

Agatti (Auoutta) group, comprises two atolls situated N.-E. and S.-W. of each other towards the extremes of an extensive plateau carry-

ing from 5 to 10 fathoms on it, which inside the 100 fathom line extends from 15 miles and forms a slight curve, the convex side to the N.-W.

The southern atoll has the island of Agatti situated on its eastern side; a broken coral reef forming a shallow lagoon extends in two arms, like claws, from its north and south extremes, leaving a good entrance for boats between. The island is four miles long by half a mile broad, its greatest breadth, as in Kavaratti, being towards its north end, narrowing to a point to the southward; a narrow shallow channel separates the south point from the small island of Kalputhi. On the western and southern side of the island a long line of coral-sand rock is exposed on the beach, as though the preceding south-west monsoon wind had removed the loose sand in the neighbourhood; also towards the south end a line of it is visible in the lagoon thirty feet from the shore, while on both sides of the sandy spit forming the south point broken and dead branches of the bushes lie on the spit. Towards the north and north-west, where the island has its greatest breadth, the lagoon beach is being added to, and coconut trees are being planted: in fact, the whole of the north end is very level, and leads to the idea that it has been comparatively recently formed by the deposition of sand from the reef and southern part of the island. The eastern side is steep too, with a narrow fringe-reef. Kalputhi is situated to the south of Agatti and is formed of coral rock and sand; its northern point extends in a sandy spit towards Agatti.

The northern atoll extends five miles east and west, and has an average width of two-and-a-half miles. The coral-reef enclosing the lagoon is somewhat rectangular in shape, and is continuous, except on the western side, where there is a broad shallow entrance; in the centre is the island of Bangarra, and two other islands and some islets are situated towards the eastern side of the atoll; they are all very low and level, and no fresh water is obtainable; as at Betra, they appear to be merely sand-cays covered with vegetation. Bangarra, the central islet, shewed signs of being washed away on its north and west sides, the coconuts on these sides having fallen and lay rotting on the beaches. The central portion of the lagoon is full of coral heads, with 2 to 4 fathoms of water between, but all round the inside of the reef is a level flat, similar to the flat at Betra and Peremul Par; it has an average width of one-third of a mile, except on the south side, where it attains a width of about three-quarters of a mile. Flood tide was found to set S. S.-E., ebb N. N.-W.

Off the western side of Bangarra, and extending out towards the entrance, are two long sandy arms which curve round towards each other and dry; they are probably formed by the deposition of the sand

during ebb, as follows—as soon as the level of the lagoon during ebb has fallen to the level of the encircling coral reef, the remaining waters have to escape by the channel on the western side; the current then is strong, and the island lying in the track, it rushes past with considerable velocity; the waters of the lagoon are filled with sand carried in during flood, and the eddy currents deposit this sand on the western side of the island, forming the two spits. From the soundings and the appearance of reef and reef-flat it seems probable that the reef is extending southward more rapidly than in other directions.

Suheli Par, of an oval-shape, extends nearly nine-and-a-half miles N. N.-E., and S. S.-W., with a width of about three-and-a-half miles. A very narrow fringe reef, broken to the N.-W., encloses a lagoon with depths of 4 to 7 fathoms in it. The S. and S.-E., sides of the atoll are occupied by a shallow sandy flat similar to the flats in Betra, Peremul, and Bungarra reefs. The reef flat extends along the east side to the north extreme, but is much narrower here than on the S. and S.-E. sides.

Two islands are situated on the reef-flat, one on the extreme north point, and the other three-quarters of a mile from the edge of the reef on the south-east side of the atoll. They are both very low and level; and like the islands at Betra and Bungarra are sand-cays, covered with vegetation. The northern of the two has in several places the sand of which it is formed cemented into coral-sand rock, which shews plainly on the eastern side, and there is still in process of formation. On the western side this rock has been broken up by the south-westerly gales, and is strewn over the beach just above high-water mark; the northern and southern extremes are formed by sand spits which appear to be extending. The south island I had no opportunity of examining, but the plan of it shews that it has two arms or spits of sand extending from the extremes to the northward, in the direction taken by the ebb current. No good water exists on either island. In addition to the islands, a sandy spit and patches of sand, which dry, extend for more than a mile along the N.-E. side of the atoll.

A shallow flat with 4 to 5 fathoms on it extends off the north end for about a mile, otherwise the hundred-fathom line lies about 2 cables from the reef. From the existence of the reef flat the atoll appears to be extending most rapidly to the south and south-east sides. The islands are apparently formed first as sand cays.

Peculiar characteristics to be noted from the foregoing observations.

1. Kiltan, Chitlac, Kardamat, Kavaratti and Agatti are all situated on the eastern side of the atolls; at Betra Par there is an islet and two

sand-cays, at Peremul Par a sand cay and patches of sand, at the northern atoll Agatti, some small islets, and at Suheli Par two islets and some sand-cays; these again are all formed on the eastern side of the reefs, with the exception of the island of Bungarra in the north atoll of the Agatti group.

2. At Kiltán, Chitlao, Kardamat, Kavaratti and Agatti, the shallow depths where live coral exists, and the flourishing condition of the edges of the coral reefs on the western and southern sides, also the extensive shelf of reef-flat inside the outer reefs at Betra Par, Peremul Par, and the northern atoll Agatti, shew that the atolls are all extending westward, southward, and in the case of Suheli Par south and south-eastward more rapidly than in other directions.

3. The islands and islets are extending at their extremities, and in some cases are being added to on the lagoon side.

4. The larger the atoll the deeper the lagoon.

5. No signs of elevation or subsidence were observed. The islet at Betra Par, although being washed away on its N.-E. and S.-W. sides, is extending at its extremities.

6. Large boulders of coral rock are found on the beach, on the east and north east sides of the islands.

7. With one exception, that of Peremul Par, the entrances to the lagoon are on the north-east, north, and north west sides: that is, to windward.

A careful study of the strong winds found in the neighbourhood of the Laccadives establishes the fact that the strongest of the ordinary monsoon winds is from west, this sometimes has a force of 4 to 5; also the vast majority of winds are from some point between N. N.-E. round to S.-W. It is evident that these winds and the seas caused by them, could not have piled up large boulders and blocks of coral on the E. and N.-E. lee sides sufficient to form the foundations of the present islands; there must have been some other agency at work, and this is probably to be found in the hurricanes of these seas. Hurricanes are rare at the Laccadives, but between these islands and the coast of India and to the south-eastward over the southern end of the Indian Peninsula, hurricanes are comparatively frequent. Their course is to the W. N.-W. or north-westward, passing up between the Laccadives and the Malabar coast. (One of these storms is mentioned in the description of Chitlao). During these storms the winds at the Laccadives would be E., N.-E. (the N.-E. being very strong) N. and then N.-W. At the latter point the wind would be moderating.

The seas due to the hurricanes would strike on the eastern and

KEY TO THE GENERA.

Stamens united in a tube.

*Cells of ovary with 1 or 2 ovules in each.

Leaflets serrate; fruit drupaceous ... 1. MELIA.

Leaflets entire; fruit baccate or capsular.

Flowers and staminal tube narrow, elongate; style elongate.

Stigmas 5 or 5-toothed; leaves trifoliolate; fruit

baccate ... 2. SANDORICUM.

Stigmas entire, single; leaves pinnate; fruit capsular
or sub-capsular.

Petals in 2 rows; ovary 7- to 9-celled, with 1 ovule
in each cell; disk short, inferior to ovary 3. MEGAPHYLLÆA.

Petals in a single row; ovary 2-to 4-celled.

Disk short, annular; ovules solitary in the cells

of the ovary ... 4. CHISOCHETON.

Disk cylindric, longer than the ovary; ovules 2
in each cell of the ovary ... 5. DYSOXYLUM.

Flowers and staminal tube globose or turbinate, style
short or absent.

Anthers included or incurved.

Petals 3; fruit dehiscent or not ... 6. AMOORA.

Petals 5; fruit indehiscent.

Style none ... 7. AGLAIA.

Style short, thick ... 8. LANSIUM.

Anthers exerted, never incurved, only partially united
into a tube (in two species of *Walsura* not united.)

Petals 5; fruit baccate, indehiscent ... 9. WALSTURA.

Petals 4 or 5; fruit capsular, dehiscent 10. HEYNEA.

**Cells of ovary 2- to 8-ovuled; stigma discoid; fruit capsular;

seeds large, fleshy, not-winged ... 11. CARAPA.

***Cells of ovary with numerous ovules in each; stigma

capitate; fruit capsular; seeds thin, winged 12. CHICKERASSIA.

Stamens distinct.

Cells of ovary 8- to 12-ovuled; seeds membranous, winged
13. CEDRELA.

Cells of ovary with 1 or 2 ovules, fruit baccate; seeds not
winged ... 9. WALSTURA.

1. MELIA, Linn.

Trees with pinnate or 2-3-pinnate leaves, toothed or entire leaflets
and panicle axillary flowers; pubescence often stellate-mealy. *Ovary*
short, 5-6 lobed, imbricated. *Petals* 5-6, free, spathulate-oblong, patent,

imbricated in bud. *Staminal-tube* cylindrical, dilated at base and apex, 10- or 12-striate and -toothed; anthers 10 or 12, included or partly exserted, short, inserted near apex. *Disk* annular. *Ovary* 3-6-celled; cells alternate to the sepals when equal in number to them. *Style* slender, nearly as long as the tube, stigma capitate; ovules 2, superposed. *Fruit* drupaceous. *Seeds* with thin fleshy albumen; cotyledons foliaceous. *Distrib.* About 12 species; Indo-Malayan.

Petals concave, obtuse; ripe drupe 1 to 1·5

in. long 1. *M. composita*.

Petals flat, sub-acute; ripe drupe ·6 to ·7 in.

long 2 *M. Azedurach*.

1. *MELIA COMPOSITA*, Willd. Sp. Plant. II 558. A tall tree; young branches rather stout, at first covered with pale loose stellate pubescence, ultimately smooth and of a dark colour. *Leaves* 1 to 2 feet long, bi- or occasionally tri-pinnate, the leaflets on each pinna 5- to 11, petiolulate, from ovate-lanceolate to ovate-rotund, often oblique at the base, acuminate, serrulate or entire; the main nerves 7 or 8 pairs, sub-horizontal, rather distinct on the lower surface; both surfaces sparsely stellate-pubescent when young, ultimately glabrous. *Panicles* shorter than the leaves, pedunculate, spreading, stellate-hairy, many-flowered. *Flowers* ·3 to ·35 in. long. *Calyx lobes* erect, ovate-lanceolate, stellate-tomentose outside, pubescent or glabrous inside, much shorter than the petals. *Petals* linear-spathulate, concave, pubescent externally, puberulous internally. *Staminal tube* nearly as long as the petals, slightly expanded at the 10-toothed mouth; the teeth bifid, silky-puberulous on both surfaces; anthers exserted, pubescent. *Stigma* 5-toothed. *Drupe* ovoid, 1 to 1·5 in. long, smooth, yellowish. *Seeds* one in each cell, smooth, pointed. W. and A. Prod. I 117. (excl. syn. *M. superba*, Roxb.); Dalz. and Gibs. Fl. Bomb. 36; Thwaites Enum. Pl. Ceyl. 59; Bedd Fl. Sylvat. t 12; Brandis For. Flora 69. *M. dubia*, Hiern (not of Cav.) in Hook. fil. Fl. Br. Ind. I, 545; De Cand. Monog. Phan. I 453; Trimen Flora Ceylon Vol. 1. 243 (exc. from all the syn. *M. superba*, Roxb.). *M. robusta*, Roxb. Hort. Beng. 33; Fl. Ind. II, 397. *M. australasica*, Adr. Juss. in Mem. Mus. XIX, 257. *M. ethiopica* and *M. Bombolo*, Welw. Apontam. Phyto-Geogr. Prov. Angola, 584 and 561. *M. argentea*, Herb. Ham. ex Wall. Cat. 1254 C.

Malacca: Maingay No. 317 (Kew Dist.), and probably in some of the other provinces. *DISTRIB.* Brit. India, Ceylon, Australia, Angola.

This is a widely-spread species, and has received many names. From the synonymy above quoted, I have excluded *M. superba* Roxb., which I believe to be a distinct species, with which the tree named *M. Birmanica* by Kurz (Journ. As. Soc. Bengal, Vol. 43, pt. 2, p. 183;

For. Flora Burm. I, 213) is probably identical. In Roxburgh's original descriptions of *M. superba* and *M. robusta*, he carefully states the differences on which he depends for their separation. These are as follow:—

M. superba.

Leaves bi-tri-pinnate, 2 to 4 feet long.

Flowers small, dull white, with an offensive smell.

Bracts small, lanceolate, caducous.

Sepals ovate-lanceolate, incurved, mealy.

Staminal tube 10-ribbed, hairy inside, each of the ten teeth of the mouth divided into 3 or 4 or 5 short subulate segments.

M. robusta.

Leaves bi-pinnate, 12 to 18 in. long.

Flowers small, white, inodorous.

Bracts solitary, filiform and often very long.

Sepals ovate-oblong.

Staminal tube with the segments of its mouth minute and filiform.

Specimens of both trees were growing in the Calcutta Garden when Roxburgh described them, the one having been received from Sunda, the other from Malabar. Roxburgh, of whose sagacity and judgment one has a thousand examples, considered them as quite distinct, and it would take a great deal more evidence than has been produced to make me believe that they are conspecific. The Malabar plant (*M. robusta*) is clearly the same as the Ceylon species which has since been identified with *M. composita*, Willd., Sp. Plantar. II 559. I cannot however agree to the view, first put forward by Mr. Hiern, that *M. composita* Willd. should be reduced to *M. dubia*, Cav. Cavanilles describes three species of *Melia*, viz., *M. azadirach*, *azadirachta*, and *dubia*, and he gives figures of the first two, but not of *M. dubia*. He describes flowers of the latter as like those of *M. Azadirachta* in size, the staminal tube as 6-toothed with a possibility of more teeth ("an pluribus?"), and the stigma as peltate. Now, as a matter of fact, the flowers of *M. composita* Willd. are in size and other respects like those of *M. Azadirachta*, and not like those of *M. Azadirachta*. The mouth of the staminal tube is many-toothed, and the stigma is ovoid, 5-toothed, and not peltate. Cavanilles' description points to a plant belonging to some other genus than *Melia*, whatever the "original specimen" named *M. dubia* in the Herbarium of the University of Rostock may be; and it is on that specimen which the reduction of *M. composita* to *M. dubia* is based. (See Hiern in Hook. fil. Fl. Br. Ind. I, 545.) No authentic specimen of *M. superba* is, so far as I know, in existence (the specimens issued by Wallich, under this name, being really *M. robusta*, Roxb.). In my opinion *M. superba* Roxb., (the Sunda i.e., Malayan) species, cannot on account of its staminal tube (densely villous internally and with numerous minute teeth at the mouth) be in-

cluded, like *M. robusta*, Roxb., under *M. composita*, Willd. For the teeth of the mouth of the staminal tube of the latter are at most bifid, while its inner surface is nearly glabrous. The only specimens of *Melia* known to me which fits Roxburgh's description in these and other respects, were collected in Burma by the late S. Kurz, and were described by him under the name *M. birmanica*, (Journ. As. Soc. Bengal, 1874, ii. 183; For Flora Burmah, I, 213). And I know of no other specimens of *M. birmanica* than those of Kurz's collecting. Certainly Maingay's No. 317 (Kew Distrib.) is not the same, as I have determined by dissecting flowers of both. *M. composita*, Willd., is not really very distinct from the Japanese *M. Toosedan*, Sieb. and Zucc., which, in turn, is closely allied to *M. Azadirach*. There are, by the way, in the Calcutta Herbarium, specimens from the Khasia Hills, Manipore, the plains of Assam and also from Sumatra, which, as far as I see, cannot be distinguished from Japanese specimens of *M. Toosedan*. If this identification be correct, the geographical area of the latter species will have to be largely extended.

M. Azadirachta, Linn., is not found in the Malayan Provinces even planted. But *M. Asadarach*, Linn., is very common planted. It presents several varieties, some of which have been elevated to the rank of species.

Roxburgh describes a Penang plant which he names *Melia tomentosa*. Of this no specimen is known now to exist. But he left an excellent coloured drawing of it in the Calcutta Herbarium, which shows it to be no *Melia* but a *Ohisocheiton*. Jack describes (Malayan Miscellanies I, 12) a Penang species which he named *Melia excolea*. The only specimens known of this are what Wallich issued (under this name) as No. 1253 b. of his catalogue. The only Wallichian specimens of this which I have seen are without flowers: they have simple long pinnate leaves, and their *facies* is not that of *Melia* but of some other genus.

2. *MELIA AZIDARACH*, Linn Sp. Pl. ed. I, 384. A small tree; young branches rather slender, at first scurfy-puberulous, afterwards dark-coloured and glabrous. Leaves 1·5 to 2 feet long, bi-pinnate, glabrous when adult; pinnæ about 3 pairs, the uppermost often 3-foliate; pinnulæ 5 to 7, opposite or sub-opposite, obliquely ovate or oblong-ovate, acuminate, shortly petiolulate, 1·5 to 2 in. long, when young coarsely serrate, when adult serrulate or sub-entire. Panicles shorter than the leaves, shortly pedunculate, spreading, lax, few-flowered, at first stellate-puberulous but ultimately glabrous. Flowers 35 in. long. Calyx-lobes oblong-lanceolate, pubescent. Petals flat, oblanceolate-spathulate, puberulous. Staminal tube lilac, expanding at the 30-toothed mouth, glabrous

outside, sparingly pubescent inside. *Style* clavate at the apex; *stigma* 10-lobed. *Drupe* oblong, smooth yellowish, '6 or '7 in. long. Linn. Hort. Cliff. 161; Cav. Diss. 7 t. 393, p. 207; Roxb. Hort. Beng. 33; Fl. Ind. ii. 395; Wight Ic. t. 160; Wall. Cat. 1250; DC. Prod. i, 621, Boiss. Fl. Orient. i. 954; W. & A. Prodr. i. 117; Adr. Juss. in Mém. Mus. xix. t. 13, f. 4; Bot. Mag. t. 1066; Bedd. Fl. Sylvat. t. 13; Brandis For. Flor. 68; Miq. Fl. Ind. Bat. I, Pt. 2, p. 533; Ann. Mus. Lugd. Bat. V. 5; Kurz For. Flora Burmah. I, 212; Hiern in Hook. fil. Fl. Br. Ind. I, 544; C DC. Monog. Phan. I, 451. *M. sempervirens*, Sw. Prodr. 67; Bot. Beg. t. 643; Roxb. Hort. Beng. 33; Fl. Ind. ii. 395; Wall. Cat. 1252; Dulz. & Gibs. Bomb. Fl. Suppl. 15. *M. Bukayun*, Royle Ill. Bot. 144; Griff. Itin. Notes 355, 403.

Planted in most of the Provinces, and in all the warmer parts of both the Old and New Worlds

2. SANODRICUM, Cav.

Trees with trifoliolate, coriaceous, entire leaflets, the lateral with a short, the terminal with a long petiolule. *Flowers* pentamerous with imbricate aestivation, in axillary panicles. *Calyx* cup-shaped, its tube adnate to the base of the ovary, its lobes short. *Petals* free, oblong, obtuse. *Staminal tube* cylindric, nearly as long as the petals, the mouth 10-toothed. *Anthors* 10 or 8, included. *Disk* tubular, embracing the ovary and base of the style. *Ovary* immersed in the calyx-tube, narrowed upwards into the columnar style, 5-celled, each cell with 2 collateral pendulous ovules. *Style* clavate at the apex. *Stigmas* 5, erect, sub-cylindric, fleshy, each surrounded at the base by a fleshy ring. *Berry* superior, sub-globular, fleshy, indehiscent, 3 5-celled, and with as many arillate seeds; the aril papery outside, pulpy inside. *DISTRIB*: About seven species—all Indo-Malayan.

Stigmas united, radiating, their apices re-curved 1. *S. radiatum*.

Stigmas distinct, erect, sub-cylindric.

Staminal tube cylindric, ventricose in the upper half 2. *S. Mainyayi*.

Staminal tube cylindric, not ventricose.

Leaflets emarginate 3. *S. emarginatum*.

Leaflets more or less acuminate ... 4. *S. indicum*.

1. *SANDORICUM RADIATUM*, King, n. sp. A tree 40 to 80 feet high. *Leaves* 6 to 12 in. long; leaflets sub-coriaceous, broadly ovate, sub-oblique, acute or shortly acuminate, the base slightly cuneate; upper surface glabrescent or glabrous, the lower pubescent on the midrib and 8 to 10 pairs of spreading sub-prominent nerves; length 3 to 6 in.,

breadth 1·75 to 4 in.; petiolules ·2 to ·5 in., the terminal one 1·5 to 2·5 in. *Panicles* with few short branches, slender, 3 to 5 in. long, few-flowered, lax. *Flowers* ·25 in. long; the pedicels about as long, slender, puberulous. *Calyx* cupular, less than half as long as the petals, with 5 shallow broad sub-acute teeth, puberulous. *Petals* narrowly elliptic, longer than the staminal tube. *Staminal tube* cylindric, not ventricose, ridged, glabrous, its mouth with ten subulately bifid teeth: anthers ovate with broad bases, included. *Ovary* cylindric, tapering into the short style; stigmas radiating, their apices recurved. *Fruit* unknown.

Perak: Wray No. 3345; King's Collector No. 6001. Singapore: Ridley No. 4822.

This differs from the other three species in its stigmas which unite to form a radiate discoid mass, the edges being recurved; while the other three species have erect slender un-united stigmas.

2. *SANDORICUM MAINGAYI*, Hiern in Hook. fl. Fl. Br. Ind. I, 554. A tree. *Leaves* 6 to 8 in. long; leaflets elliptic, sub-glabrous, sub-acuminate, the base obtuse or sub-acute; main nerves 6 to 8 pairs, depressed on the upper, prominent on the lower surface, spreading; length 2 to 5 in., breadth 1·5 to 3 in.; petiolules ·35 in., the terminal one 1·25 to 1·75 in. *Panicles* shorter than the leaves, lax, puberulous. *Flowers* ·35 to ·45 in. long, their pedicels of about the same length; bracteoles minute, subulate. *Calyx* fleshy, obscurely toothed, minutely pilose. *Petals* three times as long as the calyx, fleshy, elliptic, blunt, glabrous. *Staminal-tube* cylindrical, ventricose in the upper half, ridged; the mouth with 10 bifid teeth. *Stigmas* erect, rather long. *Fruit* unknown. C. DeCand. Mem. Phan. I, 462.

Malacca; Maingay (Kew Distrib. No. 328).

I have seen only Maingay's Malacca specimens. They resemble *S. borneense*, *Miq.*, of which I have seen the type specimen; but that species has narrower and longer leaflets with more numerous lateral nerves; it has also smaller flowers.

Mr. Hiern describes this as a tree, M. C. DeCandolle as a shrub.

3. *SANDORICUM EMARGINATUM*, Hiern in Hook. fl. Fl. Br. Ind. I, 553. A tree. *Leaves* 5 to 7 in. long; leaflets obovate to elliptic, the apex emarginate and usually mucronate, slightly narrowed to the oblique base; main nerves 5 to 6 pairs, spreading, slightly prominent; length 2 to 3·5 in., breadth 1·25 to 2 in., petiolules ·35 to ·5 in., the terminal one 1 to 1·25 in. *Panicles* short, dense; flowers ·2 in. long, shortly pedicellate. *Calyx* cup-shaped, slightly accrescent. *Staminal-tube* with 8 or 10 sub-glabrous emarginate teeth. *Fruit* (immature) sub-globular or obovoid, densely and minutely tomentose. C. DeCand. Mem. Phan. I, 461. *S. Beccarianum*, Baill. in Adansonia, 264.

Malacca: Maingay (Kew Distrib. No. 331).

I have seen only Maingay's imperfect specimens of this. The above description is copied chiefly from Hiern.

4. *SANDORICUM INDICUM*, Cav. Diss. VII, p. 359, tt., 202, 203. A tree 30 to 40 feet high. Leaves 9 to 18 in. long; leaflets broadly ovate to ovate-rotund, shortly and abruptly acuminate, the base rounded or sub-cuneate, slightly unequal; main nerves 8 to 12 pairs, spreading, impressed on the upper, prominent on the lower surface when dry; upper surface glabrous, lower pubescent or puberulous, becoming glabrescent when old; length 4 to 8 in., breadth 2 to 4.75 in.; lateral petiolules 3 to 4 in., terminal 2 to 3 in. Panicles several, scattered near the apices of the branches, only a few inches long, few-flowered, minutely rusty-tomentose. Flowers .4 or .5 in. long; pedicels .25 in., pubescent. Calyx minutely tomentose. Petals linear-elliptic, obtuse, fleshy, glabrous. Staminal tube narrow, fleshy, striate, glabrescent outside and puberulous inside. Fruit sub-globose, obtusely 5-angled at least when young, densely but minutely pubescent, 1.5 to 2 in. in diam., filled with a yellowish acid edible pulp; arillus with many spongy woody fibres; seed brown, glossy. W. & A. Prodr. i. 120; Blume Bijdr. I. 163; Adr. Jus in Mem. Mus. xix t. 16, f. 15; Hassk. Retzia, i. 146; Roxb. Cor. Pl. iii. 58, t. 261; Fl. Ind. ii. 392; Wall. Cat. 1249; Kurz For. Fl. Burma, I, 217; Hiern in Hook. fil. Fl. Br. Ind. I, 553; De Cand. Mon. Phan. I, 461; Miq. Fl. Ind. Bot. I Pt. 2., p. 541. *Sandoricum nervosum*, Blume Bijdr. I., 165; Miq. in Ann. Mus. Lugd. Bat. IV, 30. *S. ternatum*, Blanco Fl. Filip. ed. i. 346. *S. glaberrimum*, Hassk. Retzia, i. 145. *Trichilia nervosa*, Vahl Symb. i. 31. *Melia Kostjapa*, Burm. Fl. Ind. 101. *T. venosa*, Spreng. Syst. iii. 68.

In all the Provinces except the Nicobar Islands. **DISTRIB.** Siam; the Malayan Archipelago, Burma.

The fruit of this is edible, and on that account the species is occasionally cultivated.

3. *MEGAPHYLLEA*, Hemsl.

A tree. Leaves large, pinnate; leaflets opposite, slightly oblique. Panicles extra-axillary, narrow and raceme-like, shorter than the leaves. Flowers more than 1 in. across when expanded. Calyx cupular, fleshy, sub-persistent, annulate and thickened below the middle; its tube adnate to the base of the ovary, its mouth irregularly 3 to 5-lobed. Petals 10, narrowly elliptic, thickly coriaceous, in two rows, free, imbricate. Staminal-tube cylindric, its mouth obscurely crenulate; anthers 10, included. Disk cushion-shaped, many-lobed. Ovary seated on the disk, depressed, 7- to 9-celled; style thick, stigma capitate, ovules one from the central angle of each cell. Capsule large, sub-spherical, 7- to

9-lobed, 7- to 9-celled, the pericarp very thick. *Seeds* exalbuminous, compressed, exarillate, glabrous, with large hilum and conferruminate cotyledons.

DISTRIB. A single Malayan species.

MEGAPHYLLEA PERAKENSIS, Hemsl. in Hook. Ic. Plant. t. 1708. A tree 20 to 40 feet high. *Leaves* when adult 6 or 7 feet long (*vide* Hemsl.), glabrous, the petiole and rachis compressed; leaflets oblong, subcoriaceous, sub-acute; the base oblique, sub-truncate or cuneate; the larger 12 to 15 in. long, 3 to 4 in. broad; petiolules .35 to .75 in.; main nerves 10 to 12 pairs, spreading, curving, slightly prominent beneath. *Panicles* 16 to 20 in. long; the lateral branches short, racemose, few-flowered; the main rachis 4-angled, compressed. *Flower-buds* clavate, narrowed into a pseudo-stalk as long as the pedicel proper. *Flowers* 1 in. long, and about 1.25 in. in diam. when expanded, their pedicels .85 in. long. *Ovary* shortly cylindric, with a thick lobulated ring outside near the thickened base, puberulous outside. *Staminal-tube* shorter than the petals, pubescent inside below the insertion of the anthers, otherwise glabrous. *Anthers* elliptic. *Ovary* and lower half of style minutely tomentose. *Fruit* globular-pyriform, densely but minutely tomentose, about 3 in. in diam.; the pericarp 1 in. thick. *Seeds* 1 in. long.

Perak; at elevations of 3,000 to 4,000 feet, Scortechini, Wray, Curtis, King's Collector.

This genus was placed by its author provisionally next to *Chisocheton* to which it is no doubt closely allied, the points in which it chiefly differs from that genus being its two-ranked petals and 7- to 9-celled ovary. I give the length of the leaves as 6 to 7 feet on the authority of Mr. Hemsl. who, in his figure, shows the leaflets as very numerous. None of the Herbarium specimens which I have seen enable me to estimate either the length of the former or the number of the latter.

4. *CHISOCHETON*, Blume. (*Schisochiton*)

Trees or shrubs. *Leaves* equally pinnate; leaflets entire, opposite or sub opposite, more or less oblique. Flowers polygamo-dioecious, in extra-axillary, rarely axillary, divaricately-branched panicles and numerous; or in spike-like racemes or cymes and few. *Ovary* small, cup-shaped or cylindric, entire or 4-5-toothed. *Petals* 4-5 or more, usually linear-elongate or cylindric, at first cohering in a tube especially below, at length spreading, somewhat imbricated or valvate. *Staminal tube* elongate, slender, tubular, 4 to 12-lobed at the apex, lobes entire or toothed; anthers linear, equal in number to and alternate with the lobes, included or somewhat exerted. *Disk* short and fleshy,

or tubular. Ovary short, 2- 4-celled; style filiform, usually exceeding the staminal tube; stigma capitate or cylindric, usually with a ring at its base; ovules usually one in each cell. Capsule sub-globose, often beaked, thickly coriaceous, 2- 4-celled. Seeds often enclosed in an imperfect aril; cotyledons usually peltate.—DISTRIB. An Indo-Malayan genus of about 22 species.

Inflorescence only a few inches long, much shorter than the leaves, spike-like, few-flowered; fruit beaked.

Flowers .5 in. long, narrowly cylindrical in bud 1. *O. spicatus.*

Flowers .9 in. long, widely cylindrical in bud 2. *O. pauciflorus.*

Inflorescence extra-axillary, spike-like, a foot long or upwards, including the peduncle

Flowers confined to the terminal two inches of the inflorescence, the peduncles very much longer; flowers .5 or .6 in. long, 4-merous, cylindric in bud; fruit beaked 3. *O. Kunstleri.*

Flowers on short lateral branches scattered along the rachis of the inflorescence.

Flowers .75 to .1 in. long, 4- or 5-merous, clavate in bud; fruit beaked 4. *O. penduliflorus.*

Flowers 1.25 to 1.5 in. long, cylindric in bud; petals 7 to 9; fruit not beaked 5. *O. rubiginosus.*

Flowers on distant lateral glomeruli 1.25 to 1.5 in. long; petals 5; fruit sub-globular, not beaked 6. *O. princeps.*

Inflorescence extra-axillary, paniculate.

Young shoots, under surfaces of leaves, petioles, and inflorescence pubescent or tomentose.

Panicles as long as the leaves; flowers .25 in. long; petals 4, anthers much exerted from staminal tube 7. *O. glomeratus.*

Panicles about half as long as the leaves; flowers .45 in. long; anthers included in staminal tube 8. *O. erythrocarpus.*

Rachises of leaves and both surfaces of leaflets minutely pubescent; panicles

- puberulous; flowers .5 to .6 in. long,
 their buds very clavate; calyx with an
 annulus below its teeth ... 9. *C. annulatus*.
- Rachises of leaves sub-glabrous; midrib
 and nerves of leaflets minutely pubescent
 on the lower surface when young; flow-
 ers .5 to .6 in. long, cylindric in bud;
 calyx not annulate ... 10. *C. macrophyllus*.
- Leaves everywhere glabrous.
- Petals 5; leaflets 2 to 4 pairs;
 panicles longer than the leaves, much
 branched; flowers .5 in long; sta-
 minal tube truncate with about 14
 broad shallow teeth ... 11. *C. macrothyrsus*.
- Petals 4.
- Mouth of staminal tube almost
 entire, slightly waved; flowers
 .4 or .5 in. long ... 12. *C. laxiflorus*.
- Mouth of staminal tube with 6
 long lanceolate teeth.
- Flowers greenish-white, fœ-
 tid; fruit pyriform, gla-
 brous, deep red in colour... 13. *C. patens*.
- Flowers yellow, fragrant;
 fruit turbinate-globular,
 yellow when ripe ... 14. *C. divergens*.

1. *CHISOCHETON SPICATUS*, Hiern in Hook. fl. Fl. Br. Ind I, 550. A tree about 30 feet high; young shoots and inflorescence deciduously tawny-tomentose. *Leaves* 8 to 12 in. long, equally pinnate; leaflets 2 or 3 pairs, opposite, membranous, oblong-lanceolate to elliptic or ovate, shortly and bluntly acuminate, the base cuneate, slightly oblique; upper surface quite glabrous, the lower with the nerves and midrib puberulous; main nerves 4 to 6 pairs, curving; length 2.5 to 5 in., breadth 1.35 to 2 in., petiolules .25 to .35 in. *Panicles* spike-like, axillary, 2 to 3 in. long, angled, adpressed-pubescent, few-flowered. *Flowers* .5 in. long, their pedicels about .1 in., pubescent. *Calyx* deeply cup-shaped, tomentose, the mouth truncate sub-entire or irregularly toothed. *Petals* 5 (sometimes 4?) much larger than the calyx, narrowly elliptic, united by their edges, and densely and minutely adpressed rusty-tomentose outside, glabrous inside. *Staminal tube* nearly as long as the petals, narrowly cylindric, densely adpressed-pubescent outside, the mouth with 5 broad teeth. *Stamens* 5, elongate, narrow, inserted

below the mouth, included. *Ovary* narrowly elliptic; the style long, cylindric; stigma capitate with a large central mamilla. *Fruit* transversely oblong, tapering to each end, the upper end compressed, acute, the lower terete, minutely rusty-tomentose; seeds two, sub-compressed, .5 in. in diam., length (including the tapering ends) nearly 2 in., breadth .75 in. *C. DeCand. Mon. Phan.* I, 535.

Malacca: Maingay (Kew Distrib.) No 363. Perak: Soortechni. *DISTRIB:* Sumatra, Borneo.

The fruit of this is very peculiar, being in shape something like a spear-head. The central part, in which the two seeds are contained, is transversely-oblong and thick; above this is a long compressed conical prolongation filled with a little pulp, while at the base the fruit is gradually narrowed into a stalk. The sparsely-flowered spike-like inflorescence is also peculiar in the genus.

2. *CHISOCHETON PAUCIFLORUS*, King, n. sp. A shrub or small tree; young shoots slender, puberulous, the bark dark when dry. *Leaves* 5 to 15 in. long, equally pinnate; leaflets thinly coriaceous, 2 rarely 3 pairs, oblanceolate or oblong-lanceolate, sometimes ovate or elliptic, shortly and rather abruptly acuminate, the base cuneate; the upper surface glabrous, shining; the lower dull, glabrescent, reticulate, puberulous on the midrib and nerves; main nerves 5 or 6 pairs, ascending, curving, slightly prominent beneath; length 2.5 to 9 in., breadth 1 to 4 in., petiolules .1 to .2 in. *Panicles* or *racemes* from 1 to 3.5 in. long, extra-axillary, puberulous, 2- to 6-flowered. *Flowers* about .9 in., long; their pedicels .25 to .5 in., puberulous. *Calyx* fleshy, tubular, the mouth entire and truncate or with 4 or 5 shallow teeth, tomentose, about .25 in. long. *Petals* 4 or usually 6, free, about .8 in. long, fleshy, spathulate-elliptic or elliptic, blunt, minutely tomentose outside, glabrous inside. *Staminal tube* nearly as long as the petals, sub-glabrous, obscurely toothed at the mouth, the anthers from 4 to 8 or 10, varying with the number of petals, small, elliptic, included. *Disc* small, flat, tomentose. *Ovary* conical, tapering into the long cylindric style, sometimes narrowly cylindric (probably abortive). *Stigma* cylindric, obscurely 4-lobed at the apex. *Fruit* (unripe), elliptic, with a stout acute apical beak, tapered at the base, everywhere tomentose, the calyx persistent and slightly accrescent.

Perak: Soortechni; Wray, No. 2661; King's Collector, Nos. 3128, 3313, 3396, 3467 and 4455.

This species resembles *O. spicatus*, Hiern, in leaves; but has much larger flowers. Its fruit is as yet unknown. This also resembles *O. diversifolius*, Miq., in leaves, but has larger flowers.

3. *CHISOCHETON KUNSTLERI*, King, n. sp. A shrub 6 to 20 feet

high. *Leaves* 12 to 18 in. long, their petioles and rachises rusty-tomentose; leaflets 3 to 5 pairs, oblong-ob lanceolate or lanceolate, cuspidate, slightly narrowed to the cuneate base. Upper surface glabrous except the tomentose midrib; under surface rusty-tomentose, the 16 to 18 pairs of spreading curving main nerves prominent. *Spikes* supra-axillary, solitary, on very long peduncles, rusty-tomentose; peduncles 6 to 12 in., the flowering part about 2 in. *Flowers* .5 to .6 in. long, crowded, subsessile, minutely bracteolate. *Ovary* cylindric, about .1 in. long, densely tomentose, the mouth with 4 minute teeth. *Petal* 4, oblong, concave at the apex, yellowish, sericeous outside, glabrous inside. *Staminal tube* shorter than the petals and coherent with them below, glabrous, with a few scattered coarse hairs near the middle outside, the mouth with 4 broad emarginate or erose teeth; anthers 4, elliptic, included. *Ovary* ovoid, sericeous; style cylindric with a few scattered hairs, stigma cylindric with a thin annulus at its base. *Fruit* sub-globular, tomentose, with a long thick apical beak, .75 in. in diam., the beak .5 in. long.

Perak: King's Collector, Nos. 4502, 7783, Soortechni.

4. *ORISOCHETON PENDULIFLORUS*, Planch. ex Hook. fil Fl. Br. Ind. I, 550. A shrub or small tree; young branches tawny-tomentose. *Leaves* 15 to 24 in. long, their rachises tawny-tomentose: leaflets 5 pairs, opposite, with occasionally a terminal odd one, elliptic to ovate, the upper occasionally sub-obovate, all shortly acuminate; rounded at the base, or narrowed from above the middle to the sub-acute minutely cordate sub-oblique base; main nerves 15 to 18 pairs, spreading, rather prominent beneath; upper surface glabrescent, the midrib and nerves pubescent; the lower reticulate, sparsely pubescent, the midrib tomentose: length 3 to 9 in., breadth 1.5 to 3 in., petiolules less than .1 in., tomentose. *Panicles* about as long as the leaves, supra-axillary, on long drooping tomentose slender peduncles; the lateral branches few, short, densely flowered. *Flowers* .75 to nearly 1 in. long, on very short pedicels, dull red, 4- or 5- merous, clavate in bud, the lower part very slender especially in the barren flowers. *Ovary* short, tubular, the mouth entire or 4- or 5- toothed, coarsely pubescent. *Petal* 5, linear-spathulate, concave and thickened towards the apex, longer than, and in their lower part coherent with, the staminal tube, pubescent in the middle and glabrous on the edges outside. *Staminal tube* narrow, with a few coarse adpressed hairs near the apex outside, the mouth rather deeply 3- to 6- toothed, the teeth emarginate or erose. *Anthers* 3 to 5, narrow, elongate, sessile, included or slightly exerted. *Ovary* sub-ovoid, short, sub-glabrous. *Style* long, slender, adpressed-pubescent below, glabrous above. *Stigma* discoid, thick, surrounded at the base

by an annular band. *Fruit* (unripe) ovate, tomentose, on a very short thick stalk, .75 in. diam.; the apex with a curved thick blunt beak. C. De Caud. Mon. Phan. I, 586. *Melia penduliflora*, Wall. Cat. No. 1255.

Penang; Porter, Curtis. Malacca: Maingay (Kew Distrib.) No. 325. Perak; Scortechini, Wray, King's Collector.

In this species the flowers are of two kinds. One set, which are longer than the other, are very conspicuously clavate, the lower part being filiform; in these the ovary is small and infertile and the stamens are included. The other set have shorter thicker less clavate flowers, fertile ovaries, and exserted stamens.

5. *CHISOCHETON RUBIGINOSUS*, King n. sp. A tree 20 to 30 feet high. *Leaves* 2 to 3 feet long, the petiole and rachises tawny-tomentose, sub-compressed. *Leaflets* 4 to 8 pairs, coriaceous, sub-opposite, elliptic to oblong, very shortly acuminate, slightly narrowed to the rounded minutely sub-cordate base: upper surface glabrous, except the tomentose midrib and main nerves, sub-reticulate; the lower reticulate, rusty-pubescent; main nerves 12 to 18 pairs, spreading, rather straight, prominent beneath; length 5 to 12 in., breadth 2.5 to 4 in., petiolules about .1 in. *Panicles* spike-like, supra-axillary, about half as long as the leaves, on long peduncles, the branches very short and crowded near the apex, bracteolate. *Flowers* rather crowded, 1.25 to 1.5 in. long, on very short pubescent pedicels. *Calyx* cylindric, cup-like; the mouth truncate, entire or with 8 or 10 shallow irregular teeth; tomentose outside, glabrous inside. *Petals* usually 7 sometimes 8 or 9, linear, sub-spathulate, slightly concave and thickened at the apex, 1 to 1.25 in. long, tomentose externally, glabrous internally. *Staminal tube* shorter than the petals and free from them, narrowly cylindric and glabrous below, slightly expanded and pubescent at the mouth; mouth with 10 to 15 linear erect teeth: anthers from 10 to 15, elongate, alternating with the teeth and of about the same length. *Ovary* ovoid, sericeous like the cylindric style; stigma cylindric. *Fruit* (unripe) ovoid, rugose, densely rusty-tomentose, 1.5 in. long.

Perak: Scortechini, Wray, King's Collector.

This species is allied to *O. princeps*, Hemsl., but has a different inflorescence and smaller leaves. I think it possible that this may be *Melia tomentosa* Roxb., a species from Penang, of which there is no specimen extant, but of which there is a drawing (reduced in size) in the Calcutta Herbarium. The only serious discrepancy is that Roxburgh describes and figures only five petals; whereas in all the Perak specimens which I have examined there are at least 7, and in many 8, or 9, and in one even 10 petals.

6. *CHISOCHETON PRINCEPS*, Hemsl. in Hook. Ic. Plant. t. 1844.

An unbranched tree 40 feet high. *Leaves* 9 to 10 feet long; the rachises somewhat compressed, puberulous. *Leaflets* coriaceous, opposite, oblong, acute, the base rounded and slightly oblique: upper surface rugulose, shining, glabrous except the tomentose midrib and main nerves; lower surface reticulate-areolate tawny-pubescent; main nerves 15 to 30 pairs, spreading and little curved; length 9 to 18 in., breadth 2·5 to 4·5 in.; petiolule ·3 in., stout. *Panicles* spike-like, 3 feet or more in length; the branches distant, sub-sessile, glomeriform, each crowded with 20 to 30 elongate obovate shortly pedicellate flowers 1·25 to 1·5 in. long. *Calyx* 2 in. long, about one-seventh of the length of the petals, cupular, entire or with 3 or 4 rudimentary teeth, truncate, puberulous. *Petals* 5, linear-spathulate, concave at the apex, adpressed-sericeous outside, glabrous inside. *Staminal-tube* slightly adherent to and shorter than the petals, cylindric, slightly wider at the minutely 10-toothed mouth; villous in the lower half inside, otherwise glabrous; anthers 10, short, linear, sub-included. *Ovary* small, cylindric, 5-grooved, surrounded by a small annular disc. *Style* cylindric, sparsely pubescent, slightly longer than the staminal-tube, cylindric. *Fruit* sub-globular, the apex depressed, the sides vertically grooved, rusty-tomentose, 2·5 in. in diam. *Seeds* 3 to 5, 1·75 in. long.

Penang: Curtis No. 1519.

A remarkable species with very long pendulous leaves.

7. *CHISOCHYTON GLOMERATUS*, Hiern in Hook. fl. Fl. Bl. Ind. I, 551.

A tree 40 to 70 feet high; young shoots deciduously tomentose, the bark dark when dry. *Leaves* 12 to 18 in., the petiole and rachises pubescent; leaflets 2 or 3, rarely 4 pairs, thinly coriaceous, opposite, elliptic to elliptic-oblong, very shortly acuminate, the base rounded, unequal-sided; main nerves 9 to 11 pairs, spreading, prominent beneath; upper surface minutely punctate when dry, glabrous except the pubescent nerves and tomentose midrib; lower surface softly pubescent, the midrib and nerves tomentose; length 4 to 6·5 in., breadth 1·8 to 2·5, petiolule ·1 to ·15 in. *Panicles* solitary, drooping, supra-axillary, as long as the leaves; the lateral branches rather numerous, horizontal, pedunculate, each bearing several dense many-flowered small cymes, everywhere tomentose. *Flowers* 25 in. long, sub-sessile, minutely bracteolate. *Calyx* short, tubular, puberulous outside, sub-entire or irregularly toothed, much shorter than the corolla. *Petals* 4, erect, elliptic, slightly concave, glabrescent. *Staminal-tube* much shorter than the petals and coherent with them, rather wide, glabrescent, the mouth with 6 to 8 long linear teeth. *Anthers* linear, elongate, much exserted. *Ovary* ovoid, tapering into the cylindric style, and like it tomentose. *Stigma* cylindric, rather long, glabrous. *Fruit* (immature) sub-globular, on thick slightly curved pedicels,

not apiculate, but tapering at the base into a short pseudo-stalk, rusty-tomentose, 1 in. in diam., seeds two. C. De Cand. in Mon. Phan. I, 532. *Schisochiton*? Wall. Cat 9040.

Penang, Porter. Perak: King's Collector, Nos. 8462, 10227, 10624.

I am not satisfied that two closely allied species are not united under the above, as there is some difference in the number of main nerves in the leaflets, those in the specimens of King's Collector, No. 8462, being rather less numerous than in the other gatherings.

8. *CHISOCHETON ERYTHROCARPUS*, Hiern in Hook. fil. Fl. Br. Ind. I, 550. A tree; young branches rather stout, densely and minutely rusty-tomentose. *Leaves* equally pinnate, 12 to 15 in. long; leaflets 4 to 6 pairs, opposite, coriaceous, elliptic-oblong to broadly ovate, shortly abruptly and bluntly acuminate, cuneate or rounded at the slightly oblique base; upper surface glabrous except the puberulous midrib; lower softly and shortly rusty-pubescent; main nerves 6 or 7 pairs, ascending, curving; length 2.5 to 5.5 in., breadth 1.35 to 2 in., petiolules 2 in. *Panicles* clustered towards the ends of the branches, extra-axillary, about half as long as the leaves, minutely rusty-tomentose; their lateral branches short, horizontal, cymose. *Flowers* .45 in. long, their pedicels shorter. *Ovary* cylindric, the mouth truncate, sometimes minutely toothed, densely tomentose. *Petals* 6, longer than the calyx, fleshy, narrowly elliptic, blunt, adpressed-sericeous outside, glabrous inside. *Staminal-tube* shorter than the petals and pistil, outside sericeous below and glabrous above, inside villous, with 5 or 6 rather deep blunt emarginate teeth; anthers 5 or 6, included, elongate. *Ovary* narrow, pubescent; *style* tapering; *stigma* cylindric, with glabrous central mamilla. *Fruit* sub-globose, nearly 2 in. in diam, minutely tomentose, blood-red (fide Maingay) when ripe. *Seeds* ex-arillate, flattened, 1 in. long, the testa thick, orange-red. C. De Cand. in Mon. Phan. I, 534.

Malacca: Maingay (Kew Distrib.) No. 322.

9. *CHISOCHETON ANNULATUS*, King n. sp. A tree; *leaves* 18 to 30 in. long, the petioles and rachises 4-angled, pubescent; leaflets 4 to 7 pairs, membranous, oblong or elliptic-oblong, shortly and abruptly acuminate, the base cuneate, both surfaces with very minute pubescence; main nerves 12 to 14 pairs, oblique, rather prominent beneath; length about 9 in., breadth 3 to 3.5 in., petiolules .25 in. *Panicles* solitary, supra-axillary, puberulous, about as long as the leaves, with scanty spike-like few-flowered branches which become shorter upwards. *Flower-buds* clavate, .5 to .6 in. long, contracted into a pseudo-stalk at the base, their true pedicels .25 in. long. *Ovary* campanulate, rusty-tomentose outside, completely enveloping the petals in bud, with a thickened wavy band

about its middle, and 4 broad convenient triangular teeth. *Petals* 6 or more, the outer three sericeous outside and glabrous inside, the inner quite glabrous; all broadly elliptic, free from the staminal-tube. *Staminal-tube* shorter than the petals, cylindric, glabrescent, the mouth with shallow broad crose teeth. *Stamens* 12, attached at the very base of the tube; anthers linear-elongate. *Ovary* conic, apparently 5-celled; *style* cylindric, pubescent; *stigma* discoid, concave.

Porak; Scortechini No. 7000, Curtis No. 2693.

In its leaves, and also to some extent in its inflorescence, this agrees with the type specimen of *O. spectabile*, Miq., collected by Korthals in Borneo, and now in the Herbarium at Leiden. That specimen is in bud only, and neither Scortechini's nor Curtis's specimens have fully expanded flowers. The buds both of this and of *O. spectabile* are of the same clavate shape. Miquel does not describe the flowers of *O. spectabile*, and the buds in Korthal's type specimen are so young and so few, that I did not dare to dissect one of them. The buds on Scortechini's scanty specimens of this are also too young for accurate examination. But an examination of one of Mr. Curtis's discloses the structure above described. The flowers are remarkable because of the waved thickened band which runs round the exterior of the calyx just below the teeth. The ovary, moreover, of this appears to have 5 cells, whereas the species of the genus *Ohisocheton* have only 2 or 4. This character together with the lengthening of the base of the flower into a pseudo-stalk and the annular thickening of the base of the calyx, approximate this species to the genus *Megaphyllea*. In the meantime I put it into *Ohisocheton*. Good flowering specimens of this singular plant are much to be desired.

10. *CHISOCHETON MACROPHYLLUS*, King, n. sp. A tree 60 feet high. *Leaves* 5 or 6 feet long, the petiole and rachis obliquely 4-angled, subglabrous; leaflets membranous, opposite, oblong, the apex with a short blunt acumens; the base broad, rounded, unequal-sided: upper surface quite glabrous, the lower paler, minutely pubescent on the midrib and nerves when young; main nerves 18 to 20 pairs, spreading, rather prominent beneath when dry; length 5 to 13 in., breadth 3·5 to 4 in., petioles 3 in. *Panicles* 2 to 3 feet long, narrow, puberulous; the branches rather distant, from 1 to 3·5 in. long, the ultimate branchlets cymulose, many-flowered. *Flowers* 5 or 6 in. long, narrow, on pubescent pedicels less than 1 in. long. *Calyx* cupular, pubescent, about 0·5 deep, its mouth obscurely 4-toothed or entire. *Petals* 4, many times longer than the calyx, linear with spatulate concave apices, puberulous on the outer, glabrous on the inner surface. *Staminal-tube* slightly shorter than the petals, adherent to them for half its length, outside glabres-

cent below but hairy near the mouth; inside villous; mouth wider than the tube with 8 rather deep linear 2- to 3-toothed lobes; *anthers* oblong, slightly exserted. *Ovary* broadly ovoid, sericeous like the slightly compressed style; *stigma* small, cylindric, with the upper surface lobed. *Fruit* sub-globular, narrowed at the base, 3 in. in diam., the pericarp leathery thick and fleshy; pedicel very stout, swollen, 1 in. long.

Penang: Curtis No. 2469. Perak: Curtis No. 2327. Singapore: Ridley No. 4767.

11. *CHISOCHERON MACROTHYRSUS*, King, n. sp. A tree 20 to 40 feet high. *Leaves* about 2 feet long, the petiole terete, the rachis 4-angled, glabrous; *leaflets* 2 to 4 pairs, thinly coriaceous, elliptic-oblong, minutely acuminate, the base cuneate, both surfaces glabrous; main nerves 10 to 14 pairs, prominent beneath; length 3.5 to 9 in., breadth 1.5 to 3.5 in., petiolules .25 to .5 in. *Panicles* longer than the leaves, angled, glabrous; the branches distant, the lower again branched, the ultimate branchlets everywhere cymose. *Flowers* 5 in long, on very short pubescent pedicels. *Calyx* tubular, about 1 in. long, truncate or waved, pubescent. *Petals* 5, five times as long as the calyx, elliptic, thickened and concave at the apex, minutely tomentose outside, glabrous inside. *Staminal tube* shorter than and free from the petals, its apex truncate, with about 14 broad shallow teeth, sericeous on both surfaces except towards the apex; *anthers* 7 or 8, rather small, included, attached some way below the mouth. *Ovary* ovoid-conic, sericeous like the tapering style; *stigma* cylindric, glabrous, with a flat ring at its base. *Fruit* depressed-globular, sub-rugose and with several vertical ridges, minutely tomentose, 1.5 in. in diam.

Perak: Scortechini, Wray, King's Collector.

I have seen only a single specimen in which the fruit approaches maturity. The majority of the fruiting specimens are in a young stage, and the young fruits are deeply rugose and furrowed and have a small apical beak. None of the specimens I have seen have their leaves intact, and it is possible they may have more leaflets than I have described above.

12. *CHISOCHERON LAXIFLORUS*, King, n. sp. A tree 20 to 40 feet high. *Leaves* 1 to 2 feet long, glabrous; leaflets 4 or 5 pairs, opposite, thinly coriaceous, elliptic to elliptic-oblong, cuspidate, slightly narrowed at the base, both surfaces minutely reticulate; main nerves 10 to 15 pairs, curved, ascending, depressed above and prominent beneath when dry; length 5 to 9 in., breadth 1.75 to 3 in., petiolules .2 in. *Panicles* solitary, extra-axillary, slender, with a few primary branches; the secondary branches short, few-flowered, the flowers usually in distant pairs, sessile, .4 or .5 in. long. *Calyx* puberulous outside, less than .1 in. long.

shortly cylindric, mouth entire or sometimes obscurely crenate, truncate. *Petals* 4, many times longer than the calyx, linear, obtuse, slightly concave at the apex, puberulous outside, glabrous inside. *Staminal tube* nearly as long as the petals and free from them, villous outside, glabrous inside, the mouth slightly waved. *Anthers* 5, elliptic, included. *Ovary* small (in the male flowers), sericeous. *Style* longer than the staminal tube, sericeous at the base, otherwise glabrous, stigma cylindric. *Ovary* of female flower not seen. *Fruit* depressed-globose, tapering into a short pseudo-stalk, minutely tomentose, 1.5 in. in diam., crimson when ripe. •

Pernak: Scortechini, Nos. 219 and 388; King's Collector, Nos. 1876, 4348, 5735, 5765, 7783.

In many respects this resembles *O. patens*, Bl., but it has larger flowers and much less pyriform fruit. The staminal tube of this is moreover only slightly toothed at the apex, whereas that of *O. patens* has 6 long lanceolate teeth.

13. *CHISOCHERON PATENS*, Blume, Bijdr. 169. A tree 20 to 40 feet high. *Leaves* with the petiole and rachis almost glabrous, 1 to 3 feet long; leaflets 10 to 13 pairs, opposite or sub-opposite, thinly coriaceous, oblong-lanceolate, rarely oblong-elliptic, shortly acuminate, the base narrowed and unequal sided; both surfaces glabrous, reticulate, the lower pale and with the 10 to 14 pairs of curved spreading nerves and also the reticulations prominent; length 4 to 7 in., breadth 1 to 2.5 in., petiolule .15 to .4 in. *Male panicles* about as long as the leaves (the female shorter), supra-axillary, pendulous, glabrous, with numerous divergent branches the lower of which are compound, the middle spike-like, and the uppermost short and cymose. *Flowers* .35 in. long, on short rather stout pedicels. *Calyx* connate, puberulous outside; the mouth entire, truncate or wavy. *Petals* 4, three or four times as long as the calyx, sub-spathulate elliptic, glabrous, longer than and quite free from the staminal-tube. *Staminal tube* free from the petals, cylindric, expanding slightly upwards, pubescent near the mouth, otherwise glabrous outside, pubescent inside, the mouth with 6 long lanceolate teeth which are slightly shorter than the 6 linear elongate anthers. *Ovary* very small, surrounded by a notched fleshy glabrous disc; *style* cylindric, pubescent; *stigma* cylindric, glabrous. *Fruit* pyriform, attenuated below into a thick pseudo-stalk, glabrous; length 2.25 in. of which the stalk-like part is 1 in. Miq. Fl. Ind. Bat. Vol. 1, Pt. 2, 537; Ann. Mus. Lugd. Bat. IV, 29; C. De Cand. Mon. Phan. I, 528. *C. holocalyx*, Hiern in Hook. fil. Fl. Br. Ind. I, 551. C. De Cand. l. c. 529.

Malacca: Maingay (Kew Distrib.) No. 328. Singapore; Anderson No. 30, Hullett No. 800, Ridley No. 4763. Perak: Scortechini No. 324;

King's Collector Nos. 3312, 10750; Wray No. 1279. Penang: Curtis No. 1685. Pahang Ridley No. 4765.

This species, although a much smaller tree, very much resembles *C. divergens*, Bl. in its leaves and inflorescences. The leaflets, however, are of a thicker texture than those of *C. divergens* and they dry of a different colour. The flowers of the two are almost exactly alike in structure; but those of *C. divergens* are yellow and very fragrant, while those of *C. patens* are greenish-white and have a disagreeable odour like that of *Paederia foetida* and of some species of *Laricanthus*. The fruits of the two moreover differ, those of *C. divergens* being turbinate-globular or nearly so, of a yellow colour, and more or less tomentose; while the fruits of *C. patens* are of a deep red colour and glabrous when quite ripe. I have compared the type specimens of *C. patens*, Bl. and of *C. holocalyx*, Hiern, deposited, respectively, at Leiden and Kew, and I find the two to be identical.

14. *CHISOCHALON DIVERGENS*, Blume, Bijdr. 169. A tree 40 to 100 feet high; young branches glabrous, the bark dark-coloured. *Leaves* 9 to 18 in long, the main rachis deciduously puberulous; leaflets 4 to 12 pairs, membranous, opposite or sub-opposite, narrowly oblong or oblong-lanceolate, shortly acuminate, slightly narrowed to the rounded or slightly cuneate unequal base; both surfaces glabrous, reticulate, the 10 to 12 pairs of curving ascending nerves prominent on the lower when dry; length 2.5 to 6 in., breadth 1.15 to 1.75 in., petiolules .15 to .25 in. *Panicles* solitary, supra-axillary, pendulous, about as long as the leaves, pyramidal, the lower branches of the male panicles 6 or 7 in. long, of the female 4 or 5 in., the ultimate branchlets of both cyme-like, dense, many-flowered. *Male Flowers* .25 in. long, on short pubescent pedicels. *Calyx* cupular, puberulous, the mouth entire or waved. *Petals* 4, three or four times as long as the calyx and slightly longer than the staminal-tube, recurved, elliptic, obtuse, sub-glabrous. *Staminal-tube* free from the petals, widely tubular, glabrous except a few strong hairs at the throat, the mouth with 6 lanceolate spreading teeth; anthers 6, linear-elongate, about as long as the teeth of the calyx. *Ovary* small, surrounded by a narrow fleshy glabrous disc; *style* cylindric, pubescent; *stigma* small, disc-like with an annulus at its base. *Female flowers* like the males, but usually without anthers; the ovary ovoid-conic, pubescent. *Fruit* obovoid or depressed-globose, tapering at the base into a pseudo-stalk, minutely tomentose, 1.5 in. in diam., 2-celled, seeds about 2. Miq. Fl. Ind. Bat. I, Pt. 2, 537; Ann. Mus. Lugd. Bat. IV. 28; C. De Cand. Mon. Phan. I, 529. *C. fragrans*, Hiern in Hook. fil. Fl. Br. Ind. I, 551; C. De Cand. l. c. 529.

Malacca: Griffith, No. 1062/1 Maingay, (Kew Distrib.) No. 324.

36 G. King—*Materials for a Flora of the Malayan Peninsula*. [No. 1, Perak; King's Collector, Nos. 4631, 4795, 6864? Burma: Wall. Cat. 8069.

I have compared the authentic specimens of the Leiden Herbarium of *O. patens*, Blume, with the type specimens at Kew of *O. fragrans*, Hiern; and I find them to agree exactly. I therefore adopt the older name. The male panicles of this are rather longer and wider at the base than the female panicles; but both are pyramidal. I believe the plant issued by Wallich as a *Oupania* (No. 8069 of his Catalogue) may belong to this. The specimens are in fruit only and were originally named by Wallich *Trichelia longissima*.

5. DYSOXYLUM, Blume.

Trees, mostly glabrous. *Leaves* pinnate; leaflets entire, opposite subopposite or alternate, more or less acuminate at the apex and oblique at the base, coriaceous. *Flowers* paniculate, racemose or spicate, hermaphrodite. *Calyx* 4- rarely 5-fid, dentate or partite or sub-entire, imbricated, not accrescent. *Petals* 4, rarely 5, oblong, spreading, valvate or slightly imbricated. *Staminal tube* cylindrical, dentate or crenulate at the mouth; *anthers* 6, 8 or 10, short, included or the tips exerted. *Disc* tubular, equal to or twice as long as the ovary, crenulate or entire at the mouth. *Ovary* usually 3- 4-celled; style about equalling the staminal tube; ovules usually 2 in each cell. *Capsule* globose or pear-shaped, coriaceous (often thickly so), 1- 4-celled, loculicidal; seeds arillate or exarillate, exalbuminous.—

DISTRIB. Species about 100, mostly found in the Malay Archipelago, but some in Australasia.

FLOWERS PENTAMEROUS. ... 1. *D. arborescens*.

FLOWERS TETRAMEROUS.

Inflorescence paniculate

Panicles slender, lax, few-flowered.

Leaflets linear-lanceolate; flowers '6 in. long ... 2. *D. angustifolium*.

Leaflets oblong-lanceolate, caudate-acuminate; flowers '15 in. long ... 3. *D. dumosum*.

Panicles with few branches; the branchlets very short, spicate, distant; the flowers only '1 in. long, densely crowded ... 4. *D. interruptum*.

Panicles with many divaricating branches, many-flowered.

Leaflets minutely rugulose when dry, their main nerves indistinct ... 5. *D. acutangulum*.

Leaflets not rugulose when dry, their
main nerves distinct

Veins of leaflets winged; flowers

·25 in. long ... 6. *D. venulosum*.

Veins of leaflets not winged.

Disc hairy, slightly exceeding
the sub-strigose ovary;
flowers ·15 in. long ...

7. *D. thyrsoidesum*.

Disc glabrous, half as long as
the style, slightly constricted
below the thickened pilose
mouth, ovary densely
pilose, flowers ·45 in. long

8. *D. turbinatum*.

Disc glabrous, slightly longer
than the glabrous
ovary; flowers ·2 in. long

9. *D. costulatum*

Disc glabrous outside, pubescent
inside, much longer
than the densely adpressed-
pubescent ovary; flowers ·5
in. long ...

10. *D. macrothyrsus*.

Inflorescence spicate or racemose.

Spikes or racemes from the stem or from
the branches below the leaves

Disc membranous, glabrous, obscurely
crenate, longer than the densely
pilose narrowly ovoid ovary;
flowers 3 to 35 in. long, fruit
ovoid, apiculate, glabrous

11. *D. cauliformis*.

Disc fleshy, longer than the tomentose-
lepidote sub-globular ovary,
flowers ·25 in. long, fruit ovoid,
rusty-tomentose ...

12. *D. Griffithii*.

Disc thinly fleshy, glabrous, crenulate,
longer than the depressed
sericeous ovary; flowers ·15 in.
long, fruit obovoid, apiculate, obscurely
4-angled, tawny-tomentose

13. *D. densiflorum*.

Disc membranous, glabrous outside,
pubescent inside, as long as the
ovoid-conic sparsely pilose ovary;
flowers ·35 in. long, fruit sub-
globose ...

14. *D. cuneatum*.

Spikes or racemes axillary.

Spicate cymes or racemes from 4 to 8 in. long.

Disc fleshy, glabrous, crenulate, slightly longer than the hemispheric densely puberulous ovary; flowers 2 in. long ... 15. *D. racemosum*.

Disc puberulous, with thickened rugulose pilose mouth, longer than the ovoid-conic pubescent ovary; flowers 6 in. long ... 16. *D. microbotrys*.

Spikes from 2 to 4 in. long.

Disc glabrous, longer than the puberulous 4-furrowed ovary; flowers 35 in. long ... 17. *D. flavescens*.

Spikes or racemes not more than 2 in. long.

Leaves not rugulose when dry.

Disc fleshy, annular, crenulate, shorter than the conic pubescent ovary; flowers 5 in. long ... 18. *D. andamanicum*.

Leaves rugulose or papillose

Disc fleshy, glabrous, 8- to 9- toothed, exceeding the hemispheric ridged puberulous ovary; flowers 2 in. long ... 19. *D. rugulosum*.

Flower buds globose, 15 in. in diam.; calyx campanulate, disc none, or very small, ovary broadly ovoid ... 20. *D. papillosum*.

1 *DYSOXYLUM ARBORESCENS*, Miq. in Ann. Mus. Lugd. Bat. IV, 24. A tree 20 to 30 feet high. Leaves 6 to 9 in. long, unequally pinnate, glabrous; leaflets 2 to 3 pairs, membranous, opposite or sub-opposite, elliptic (sometimes rather broadly so), slightly obovate, shortly abruptly and obtusely acuminate, the base very cuneate, main nerves 6 to 8 pairs spreading, curving, not prominent on either surface; length 2.5 to 5 in., breadth 1.25 to 2.25 in., the odd leaflet usually the largest; petiolules slender, .3 to .5 in., that of the odd leaflet often 1 in. Panicles extra-axillary, solitary, 1.5 to 4 in. long, with a few short lax-flowered divaricating branches. Flowers .25 in. long, on thin pedicels of the same length. Calyx a very shallow obscurely toothed cup. Petals 5, linear, slightly thickened and narrowed towards the apex, glabrous, longer than the sta-

minal tube. *Staminal tube* widely cylindric, inflated or not at the base, shorter than the style, glabrous, with 10 broad shallow sub-crenate teeth; *anthers* small, ovate, included, or the tips exerted. *Disc* widely tubular, thick, fleshy, sub-crenulate, longer than the ovary. *Ovary* depressed, ovoid-globular, pubescent, 4-celled; *style* cylindric, sparsely pubescent below, glabrous above; *stigma* discoid with a broad projecting annulus at its base. *Fruit* turbinate, with 3 or 4 (sometimes only 2) vertical grooves, glabrous, not narrowed into the stalk, 1.25 in. in diam., 2- to 4-seeded. *Seeds* ovoid, apparently ex-axillate. C De Cand Mon. Phan. I, 489, (excl. syn *D. lampungum*, Miq.) *D. Maingayi*, Hiern in Hook. fl. Fl. Br. Ind. I, 547; C De Cand. l. c. 490. *Goniocheton arboreascens*, Blume Bijdr. 177: Miq. Fl. Ind. Bat. I, pt 2, p. 540. *Hartigsea acuminata*, Miq. Fl. Ind. Bat. Suppl. 196, 504. *Trichelin arboreascens*, Spreng. Syst. Vol. IV, cur. post. p. 252.

Malacca: Maingay (Kew Distrib.) No 359. Perak: Scortechini, Wray. S Andaman, King's Collectors. DISTRIB. the Malayan Archipelago.

The flowers of some of the Andamans specimens are 6-merous.

2. *DYSOXYLUM ANGUSTIFOLIUM*, King n. sp. A glabrous tree; young branches slender, terete. *Leaves* 10 to 12 in. long, equally pinnate; leaflets about 5 pairs, opposite, membranous, linear-lanceolate, the base much narrowed; main nerves 9 to 12 pairs, oblique, little curved, obsolete on the upper, faint on the lower, surface; length 3.5 to 5.5 in., breadth 5 to 6.5 in., petiolules 25 in. *Panicles* extra-axillary, slender, lax, 1.5 to 4.5 in. long. *Flowers* .6 in. long, each at the apex of a short minutely bracteolate branchlet. *Calyx* shortly cupular, with 4 triangular teeth, glabrous, fleshy, tapering below into a short fleshy pedicel. *Petals* 4, many times longer than the calyx, linear-oblong, sub-acute, slightly thickened and connivent at the apex, minutely puberulous outside, glabrous inside. *Staminal tube* nearly as long as the petals, cylindric, rather fleshy like the petals, glabrous, very slightly wider at the obscurely 8-toothed apex; *anthers* 8, elliptic-oblong, included. *Disc* tubular, much longer than the ovary, and one-third of the length of the style, fleshy, glabrous except at the thickened obscurely 8-toothed pubescent mouth. *Ovary* ovoid, 4-angled, puberulous, 4-celled, tapering into the long 4-angled puberulous style; *stigma* slightly exerted, rather small, discoid, with a broad basal annulus. *Fruit* (unripe) obovoid, tapering much at the base, glabrous, about 1 in. long, peduncle 1 in.

Pahang; Ridley, Nos. 2656 and 5840.

The flowers of this have a strongly alliaceous odour.

3. *DYSOXYLUM DUMOSUM*, King, n. sp. A shrub 3 to 6 feet high.

Leaves 5 to 14 in. long, equally pinnate, the petioles angled and channelled in front; *leaflets* opposite, 2 or 3 rarely 5 pairs, membranous, oblong-lanceolate, shortly and bluntly caudate-acuminate, much narrowed to the base; main nerves 7 or 8 pairs, curved, quite obscure on both surfaces, length 2.5 to 4.5 in. rarely 5 in.; breadth .75 to 1.45, rarely 1.75 in., petiolules 2 in. *Panicles* shorter than the leaves, extra-axillary, pedunculate, with a few spreading scantily-flowered branches in the upper part, or racemose and branched from the base, 1.5 to 4 in. long. *Flowers* .15 in. long, on bracteolate pedicels as long as or longer than themselves. *Ovary* cupular, much shorter than the petals, glabrous, with 4 (rarely 5) small teeth. *Petals* 4, slightly unequal, broadly oblong with truncate bases, obtuse, the apex thickened and slightly incurved, glabrous or sub-glabrous. *Staminal tube* shorter than the petals and adherent to their bases, widely cylindric, glabrous, the mouth with 8 broad shallow emarginate teeth; anthers alternate with the teeth, shortly ovate, sub-exserted. *Disc* fleshy in the fertile female flowers, slightly longer than the ovary and lobed; in the fertile male flower shorter and entire. *Ovary* depressed, pilose; *style* cylindric, sparsely pilose below; *stigma* in the fertile female broadly discoid, 5-angled, with an annular disc beneath it, in the fertile male cylindric. *Fruit* depressed-globular, glabrous, .5 in. in diam., crowned by the base of the style, 4-celled, with 3 or 4 shining black seeds.

Perak: Scortechini, King's Collector. Johore: Ridley, No. 4194.

In habit this resembles *D. arborescens*, from which, however, it is at once distinguished by its equally pinnate leaves and tetramerous flowers.

4. *DYSOXYLUM INTERRUPTUM*, n sp. King. A tree 30 to 40 feet high; young branches cinereous-pubescent. *Leaves* 24 to 30 in. long, equally pinnate; leaflets about 10 pairs, membranous, sub-opposite or opposite, oblong to elliptic-oblong, shortly and sharply acuminate, the base cuneate; upper surface glabrous, the nerves and midrib pubescent; lower surface puberulous, the 18 to 24 pairs of straight sub-ascending main nerves rather prominent and with long sparse hairs; length 5 to 7 in., breadth 2.25 to 2.75 in., petiolules .1 to .2 in. *Panicles* solitary, slightly supra-axillary, with few spreading branches; the ultimate branchlets very short, distant; the flowers ovoid, densely crowded, sessile, .1 in. long. *Calyx* cupular, pubescent, with 4 or 5 triangular acute spreading teeth. *Petals* 4, longer than the calyx, erect, valvate, elliptic, sub-acute, the sides straight, pubescent outside, puberulous inside. *Staminal tube* shorter than the petals, cylindric, glabrous, the mouth with 8 rather broad bifid teeth. *Anthers* 8, short, elliptic, included. *Disc* shortly cylindric, longer than the ovary, fleshy, glabrous; its

mouth with 8 obscure broad blunt teeth. Ovary depressed and broadly ovoid, pilose, 3-celled; style short, stout; stigma thickly discoid with an annulus at its base. Fruit unknown.

Perak: King's Collector, No 6349.

A very distinct species distinguished at once by its small densely crowded flowers in interrupted spicate panicles.

5 *DYSOXYIUM ACUTANGULUM*, Miq Fl. Ind Bat Suppl 196, 508; Ann Mus Lugd. Bat IV, 26. A glabrous tree, the young branches rather stout with pale brown striate bark. Leaves 6 to 12 in. long, equally pinnate the rachis and petiole 4-angled leaflets 3 or 4 pairs, coriaceous, opposite or sub-opposite, unequal-sided especially towards the more or less acute base, elliptic or ovate, or sometimes slightly obovate, the apex acute or shortly acuminate, both surfaces minutely rugulose and of a pale olivaceous colour when dry, main nerves imperceptible, length 2.5 to 4.5 in., breadth 1.25 to 2.2 in., petiolule .2 to .25 in. Panicles 2.5 to 4 in long, spreading, puberulous. Flowers rather crowded, .35 in long. Calyx puberulous, very shallow, with 4 deep reflexed triangular teeth. Petals 4 thin, much larger than the calyx, oblong, sub acute puberulous on both surfaces. Staminal tube a little shorter than the petals, cylindric, the mouth with 8 rather deep sharp teeth striate puberulous on both surfaces, anthers 8, oblong, rather small, slightly exerted. Disc widely tubular, slightly exceeding the ovary, fleshy, its mouth slightly inflexed obscurely 6-toothed. Ovary adpressed-pubescent, broadly ovoid, tapering into the long style. style glabrescent in its upper part, adpressed-pubescent in the lower. Stigma exerted shortly cylindric, with a small annulus at its base. Fruit obovoid 3 in long, the pericarp very coriaceous, glabrous, pale brown when dry and minutely rugulose, 3 celled. Seeds one in a cell, ellipsoid and apparently when fresh embedded in pulp O DC in Mon Phan I, 525.

Singapore Ridley, No 3828 Perak Scortechini, No 1048. DISTRICT Bangka.

The late Fr Scortechini collected only a single specimen of this which is in flower, and Mr Ridley collected it in fruit in Singapore. These specimens agree absolutely in their leaves with a specimen from Bangka now in the Leiden Herbarium on which Miquel founded the species.

Miquel does not describe the flowers, and the specimen lent to me by the Leiden Herbarium has none. In the Leiden Annals, Miquel expresses a doubt whether this plant may not be Aurantiaceous. The flowers (which Miquel had never seen) are however unmistakably Meliaceous, and the leaflets moreover are not pellucid-dotted.

6. *DYSOXYLUM VENULOSUM*, King, n. sp. A tree 50 to 80 feet high; young branches rather stout, angled, puberulous. *Leaves* 12 to 18 in. long, the petiole and rachis angled and puberulous, equally or unequally pinnate; leaflets 7 to 14, membranous, alternate, oblong, slightly unequal-sided, acuminate, the base much narrowed and oblique; both surfaces glabrous, the 13 to 15 pairs of oblique curving main nerves indistinct on the upper, rather prominent on the lower, the veins on both surfaces prominent and winged when dry; length 5 to 7 in., breadth 1.35 to 1.75 in., petiolules .25 in. *Panicles* extra-axillary, 6 to 8 in. long, glabrescent; the branches numerous, short, sub-horizontal, few-flowered. *Flowers* .25 in. long; their pedicels about the same length, jointed at the middle. *Calyx* cupular, with 4 shallow teeth, glabrous. *Petals* 4, much longer than the calyx, densely hairy, puberulous externally, sparsely so internally, oblong, obtuse, the apex slightly thickened and inflexed. *Staminal tube* slightly shorter than the petals, glabrous, cylindric, its mouth irregularly and minutely toothed; anthers 8, oblong, inserted below the mouth of the tube. *Disc* cylindric, fleshy, glabrous, about as long as the ovary, the mouth with 4 broad minutely erose teeth. *Ovary* ovoid, hoary-pubescent, tapering into the long cylindric sub-glabrous style; *stigma* slightly exserted, thickly discoid with an annulus at its base. *Fruit* unknown.

Perak: King's Collector, No. 1036.

7. *DYSOXYLUM THYRSOIDNUM*, Griff. ex Hook. fil. Fl. Br. Ind. I., 547. A tree; leaves 12 to 16 in. long, their petioles and rachises angled; leaflets about 8, alternate, coriaceous, elliptic-oblong to elliptic, shortly acuminate, slightly narrowed to the oblique base, both surfaces quite glabrous; main nerves 6 to 8 pairs, curved, ascending, slightly depressed in the upper and prominent on the lower surface when dry; length 4.5 to 8.5 in., breadth 1.75 to 3 in., petiolules .3 in. *Panicles* slightly extra-axillary, pyramidal, with stout rachises less than half the length of the leaves; their main branches divaricating, the ultimate racemose; flowers numerous, 15 in. long, their pedicels nearly as long. *Calyx* one-third of the length of the petals, cupular, coarsely and irregularly 4-toothed, glabrous. *Petals* 4, oblong, obtuse, glabrous. *Staminal tube* shorter than the petals and attached to them, cylindric, glabrous outside, pubescent inside, its mouth with 8 broad sub-crenate teeth; *anthers* short, ovate, included. *Disc* tubular, fleshy, hairy, slightly exceeding the ovary, truncate. *Ovary* narrowly ovoid, sub-strigose, 3-celled; *style* cylindric, thick, as long as the staminal tube; *stigma* exserted, discoid with a basal ring. *Fruit* (fide Hiern) "obovoid, fleshy, 2-3-lobed, umbilicate, nearly 1 in. long; fruiting peduncles woody, stout, seeds ex-arillate." C. DC. in Mon. Phan. I., 481.

Malacca, Griffith, (Kew Distribution) No. 1053. Penang: Curtis, Nos. 2467, 2468. Andamans: King's Collectors.

Var. *Andamanica*: flowers .25 in. long, calyx very short: panicles sometimes as long as the leaves, lax.

S. Andamans. King's Collectors.

This differs from typical *D. thyrsoides* chiefly in the points above noted. When better specimens of the typical Malacca form are obtained, characters may be found sufficient to separate the two specifically.

8 *DYSOXYLUM TURBINATUM*, King n. sp. A small tree 12 to 20 feet high; young branches rather stout, the bark pale brown and striate. *Leaves* 10 to 16 in. long, the petioles and rachises glabrous, terete, equally pinnate, leaflets 2 to 4 pairs, sub-opposite, thinly coriaceous, elliptic to elliptic-oblong, shortly and bluntly acuminate, the base rounded or slightly narrowed, not oblique; both surfaces glabrous, the lower subglaucescent, very minutely dotted, the nerves pubescent when young; main nerves 8 to 11 pairs, curved, spreading, very prominent on the lower, slightly depressed on the upper surface; length 3 to 6 or even 8 in., breadth 1.5 to 2.5 in. or even 3.5 in., petiolules .35 in. *Panicles* supra-axillary, 3 to 11 in. long, puberulous, rather slender, with few distant minutely bracteolate branches each bearing 5 to 10 flowers mostly in its upper half. *Flowers* .45 in. long. *Calyx* cupular, pubescent, narrowed to a short fleshy pedicel, its mouth with 4 short triangular teeth. *Petals* 4, linear-oblong, thickened and slightly concave at the apex, minutely adpressed-pubescent outside, with a few fleshy hairs inside at the apex, otherwise glabrescent. *Staminal tube* cylindric, slightly shorter than the petals, the mouth with 8 shallow broad truncate teeth, puberulous outside, glabrous inside. *Antlers* oblong, short, included. *Disc* half as long as the style, tubular, slightly constricted below the thickened pilose mouth, otherwise glabrous. *Ovary* narrowly ovoid, densely pilose; style 4-angled, glabrescent; stigma slightly exerted, small, discoid, with a basal annulus. *Fruit* depressed-globose, tapering at the base into a short pseudo-stalk, covered with brownish pale-edged scales, 1.5 in. length (excluding the pseudo-stalk) and slightly more in diameter.

Perak: King's Collector, No. 8751. Johore: Herb. Ridley, No. 4060. Malacca: Griffith.

In the above description the flowers are described from the specimens of Mr. Ridley and of my own collector, and the fruit from a single Griffithian specimen from Malacca which has no flowers, the three being in my opinion identical.

9. *DYSOXYLUM COSTULATUM*, Miq. in Ann. Mus. Lugd. Bat. Vol. IV.,

21. A glabrous tree 40 to 50 feet high. *Leaves* 9 to 14 in. long; *leaflets* sub-coriaceous, opposite, about 4 pairs, elliptic-oblong or elliptic, cuspidate or shortly acuminate; the base acute, slightly oblique; main nerves 10 to 12 pairs, curved, spreading, stout and prominent on the lower surface; length 3·5 to 6 in., breadth 1·5 to 2·75 in., petiolules about ·3 in. *Panicles* axillary or terminal, about half as long as the leaves or less; their branches divaricating and racemoid, glabrous. *Flowers* not crowded, about ·2 in. long, on short pedicels, bracteolate; pedicels cylindric in bud. *Calyx* a very short obscurely 4-toothed cup. *Petals* 4, oblong, obtuse, minutely puberulous externally. *Staminal tube* free from and nearly as long as the petals, cylindrical, the mouth with 8 broad shallow crenulate teeth, glabrous outside, villous inside. *Anthers* 8, short, ovate, included. *Disc* tubular, glabrous, crenately 4-toothed, longer than and surrounding the ovary. *Ovary* glabrous, narrowly ovoid, tapering into the cylindric style. *Stigma* slightly exserted, discoid with a band round its base. *Fruit* depressed-globular with 3 shallow vertical grooves; tapering at the base into a pseudo-stalk, 1·5 in. or more in diam., 4-celled; the pericarp woody, glabrous. *Seeds* sub-globular. C. De Cand. in Mon. Phan. 1, 503. *D. brevipes*, Hiern in Hook. fil. Fl. Br. Ind. 1, 560; C. DC. in Mon. Phan. 1, 503. *Hartighsea costulata*, Miq. Fl. Ind. Bat. Suppl. 196, 505.

Malacca: Griffith; Maingay, Nos. 319, 320 (Kew Distrib.), Stolickza, Wray, King's Collector. *Puhang*: Ridley. *Singapore*: Ridley. *Distrib.* *Sumatra*.

The type specimens of *D. brevipes* Hiern at Kew agree exactly with those of the older *D. costulatum* Miq. in the Royal Herbarium at Leiden.

10. *DYSOXYLUM MACROTHYRSUM*, Miq. in Ann. Mus. Lugd. Bat. IV.,

20. A tree 30 to 60 feet high; young branches rather stout, striate. *Leaves* 11 to 16 in. long, equally pinnate, the petioles and rachises puberulous; *leaflets* thinly coriaceous, 3 or 4 pairs, opposite, oblong-lanceolate to elliptic-oblong or elliptic, shortly acuminate, the base cuneate and slightly oblique; upper surface glabrous except the sometimes puberulous midrib, the lower glabrous; main nerves 8 to 11 pairs, spreading, prominent and almost winged on the lower faintly depressed on the upper surface; length 3 to 5·5 in. or even 7 in., breadth 1·5 to 2·25 in., petiolules ·25 to ·4 in. *Racemes* slightly supra-axillary, slender, puberulous, few-flowered, 4 to 7 in. long. *Flowers* ·5 in. long, distant, on short bracteolate pedicels. *Calyx* a short fleshy rugulose puberulous cup, with 4 broad triangular teeth. *Petals* 4, deflexed, many times longer than the calyx, narrowly oblong, slightly widened at the base; the apex sub-acute, slightly thickened and inflexed, externally with dense pale adpressed hairs, internally glabrescent. *Staminal tube*

shorter than the petals, cylindric, adpressed-pubescent outside, the mouth almost entire or minutely toothed. *Anther* 8, linear-elliptic, their apices not reaching the mouth of the tube. *Disc* much longer than the ovary, cylindric, glabrous externally, softly pubescent internally especially at the acutely 8-toothed mouth. *Ovary* narrowly ovoid-conic, tapering into the long glabrous cylindric style, 4-angled, densely adpressed-pubescent; stigma exserted, thickly discoid, rugulose, with a narrow annulus at its base. *Fruit* turbinate, with four shallow vertical grooves and four broad rounded angles, sub-glabrous, crowned for a time by the persistent stout short style, when fully ripe white slightly tinged with pink, about 1.25 in. long, and 1.5 in. or more in diam. C DC in Mon Phan. I, 485. D *Lampangun*, Miq Fl Ind. Bat. Suppl. 196, 303 (excl var B, vide Miq Ann Mus Lugd Bat IV., 20.)

Perak King's Collector, Nos 5223 6748, 10140; Wray, Nos. 2329, 3072 Selangore. Ridley, No 1892 Distrib Borneo

I follow Miquel and M. C. de Candolle in keeping this species up. It is, however, very closely allied to *D. excelsum*, Bl. The panicles of Perak specimens are rather shorter and fewer-flowered than in those collected in Borneo, in other respects they agree

11. *DYSONALUM CALIFLORUM*, Hieron in Hook fil Fl. Br. Ind. I., 549. A tree 30 to 50 feet high. *Leaves* 1 to 2 feet long, their petioles and rachises deciduously rusty-pubescent, angled, unequally pinnate; leaflets 9 to 13, membranous, opposite or alternate, oblong-elliptic or elliptic, shortly acuminate, the base cuneate or rounded at one side and obliquely cut away at the other, both surfaces glabrous except the pubescent midrib, main nerves 8 to 13 pairs, spreading, rather prominent on the lower surface, length 4 to 7 in. occasionally 12 in., breadth 1.75 to 2.75 in., petiolules 2 to 3 in. *Spikes* from 1 to 3 in. long, tawny-tomentose, in dense clusters on rugose woody tubercles from the stem. *Flowers* 3 to 35 in. long, then pedicels about .1 in., bracteolate at the base. *Calyx* cupular, with 3 or 4 broad irregular teeth, pubescent. *Petals* 4, oblong, obtuse, glabrous inside, glabrous or pubescent outside, free from the staminal tube. *Staminal tube* cylindric, glabrescent or sparsely sericeous outside, sericeous inside, the mouth with 8 broad shallow hind teeth, *anthers* 8, ovate, included. *Disc* tubular, membranous, longer than the ovary, glabrous, the mouth obscurely crenate. *Ovary* narrowly ovoid, densely pilose, the style cylindric, sparsely pilose in the lower, glabrous in the upper half. *Stigma* slightly exserted, broadly discoid with a narrow annulus at its base. *Fruit* ovoid, apiculate, tapering slightly at the base, sub-striate, glabrous, red-coloured, splitting into 4 valves. *Seeds* sub-globular, plano-convex, .5 in. long C DC in Mon Phan. I, 498.

Malacca: Griffith, Maingay, No. 327 (Kew Distrib.). Singapore; Anderson, Hullet. Perak: Scortechini, Wray, King's Collector.

12. *DYSOXYLUM GRIFFITHII*, Hiern in Hook. fil. Fl. Br. Ind. I., 549. A tree. Leaves 12 to 18 in.; leaflets 9 to 13, membranous, alternate, oblong-lanceolate, acuminate, the base cuneate, glabrous, shining, (olivaceous when dry); main nerves numerous, spreading, indistinct on both surfaces, the midrib thin but slightly prominent on the lower; length 3 to 5 in., breadth 1 to 1.5 in., petiolules .1 in., Racemes from the axils of fallen leaves, .5 to 1.5 in. long, stout, minutely bracteolate. Flowers .25 in. long, their pedicels less than .1 in. Calyx nearly flat, very short. Petals 4, oblong, obtuse, puberulous outside. Staminal tube slightly shorter than the petals, cylindric; its mouth with 8 broad shallow sub-emarginate teeth, puberulous outside; anthers 8, ovate, their tips exserted. Disc shortly cylindric, crenulate, fleshy, longer than the ovary. Ovary sub-globular, 4-angled, minutely tomentose-lepidote, 3- to 4-celled. Style as long as the staminal tube, 4-angled, puberulous: stigma discoid with an annulus at its base. Fruit unknown. C. DC. in Mon. Phan. I., 497. *Hartighsea ramiflora*, Griff. Notulæ IV., 501.

Malacca, Griffith.

This does not appear to have been collected since Griffith originally found it (1845) at Malacca. It is a very well-marked species, and Griffith's original description of it is, in all respects except that of fruit, full and clear.

13. *DYSOXYLUM DENSIFLORUM*, Miq. in Ann. Mus. Lugd. Bat. IV, 9. A tree 20 to 40 feet high. Leaves unequally pinnate, 15 to 20 in. long, their petioles and rachises angular, deciduously puberulous. Leaflets 11 to 13, opposite or alternate; the terminal larger than the others; more or less obovate and with a longer petiolule; lateral leaflets elliptic or elliptic-oblong, slightly oblique, acute or shortly acuminate, the base rounded or sub-cuneate and unequal, both surfaces glabrous; main nerves 10 to 12 pairs, spreading, curved, slightly prominent beneath; length 4.5 to 7 in., the terminal 1 or 2 in. longer; breadth 2 to 2.5 in., the terminal sometimes 3 in.; petiolules .15 in., the terminal .75 to 1 in. Spikes in clusters from woody tubercles on the stem, 1 to 2 in. long, tawny-tomentose. Flowers (in bud only), about .15 in. long, sub-globular, their pedicels slightly shorter with bracteole at the base. Calyx almost as long as the petals, campanulate, coarsely pubescent, its mouth with 4 large irregular teeth. Petals 4, free, slightly imbricate, sub-orbicular (in bud), the apex slightly inflexed. Staminal-tube nearly as long as the petals, glabrous, widely tubular, divided almost to the base into 8 broad sub-truncate erose teeth; anthers

8, included, elongate-elliptic, alternate with the lobes. *Disc* cylindric, short but longer than the ovary, thinly fleshy, crenulate, glabrous. *Ovary* depressed, 4-celled, sericeous as in the base of the short stout style; *stigma* slightly exserted, discoid. *Fruit* (young) narrowly obovoid, shortly apiculate, narrowed at the base into a pseudo-stalk, obscurely 4-angled, densely but minutely tawny-tomentose, 1.5 in. long, including the pseudo-stalk. C. DC. Monog. Phan. I, 499. *Epicharis densiflora*, Blume Bijdr. 167; Miq. Flor. Ind. Bat. Vol. I, pt. 2, p. 539. *Epicharis altissima*, Blume ex Miq. l.c. *Guarea densiflora*, Spreng., Syst. IV, 251.

Perak: King's Collector, Nos. 4934, 8826, 10093 and 10448. Wray No. 437. Scortechini, No. 1661. DISTRIB. Java, Sumatra.

In the youngest stages the fruit is ovoid: as it ripens it becomes obovoid and the base becomes narrowed into a pseudo-stalk.

14. *DYSOXYLUM CUNEATUM*, Hiern in Hook. fil. Fl. Br. Ind. I, 551. A large tree. *Leaves* 18 to 30 in. long, unequally pinnate; leaflets about 18, sub-coriaceous, opposite or sub-opposite, elliptic-oblong, shortly cuspidate; the base cuneate, unequal-sided; both surfaces glabrous, the lower punctate, main nerves 14 to 17 pairs, spreading, slightly prominent beneath when dry; length 4 to 7 in., breadth 2 to 3 in.; petiolules .15 in., stout, that of the terminal leaflet .75 in. *Spikes* cinereous-tomentose, only a few inches long in flower, but elongating much in fruit, (from the branches below the leaves?) clustered. *Flowers* .35 in. long, sub-sessile, bracteolate. *Calyx* half as long as the petals, campanulate, with 4 obtuse irregular deep teeth, pubescent. *Petals* 4, oblong, sub-imbricate, sub-glabrous. *Staminal-tube* longer than the petals, glabrescent outside, villous inside, the mouth with 8 obtuse shallow teeth. *Anthers* 8, shortly ovate, included. *Disc* membranous, tubular, about as long as the ovary, glabrous outside, pubescent inside, its mouth minutely crenulate. *Ovary* ovoid-conic, pilose; style cylindric, sparsely pilose in the lower part, glabrous above, *stigma* discoid with an annulus at its base. *Fruiting-spike* half as long as the leaves: ripe fruit sub-globose, about 1 in. in diam., sub-glabrous, the pericarp splitting into about 4 valves; seeds oblong, plano-convex, .75 in. long, C. DC. in Mon. Phan. I, 496.

Malacca: Maingay (Kew DISTRIB.), No. 322-2.

Known only by Maingay's scanty specimens; allied to *D. cauliflorum* in inflorescence flowers and fruit.

15. *DYSOXYLUM RACEMOSUM*, King n. sp. A shrub, all parts glabrous except the young shoots and the inflorescence. *Leaves* 12 to 18 in. long, equally pinnate. *Leaflets* membranous, alternate, elliptic-oblong, the apex shortly acuminate, the base broad, slightly unequal; main nerves 8 to 10 pairs, curving, spreading, slightly prominent beneath,

length 5 to 8 in., breadth 2·25 to 3 in., petiolules ·25 in. *Racemes* slightly supra-axillary, solitary, 4 to 5 in. long, puberulous. *Flowers* scattered, 2 in. long, on slightly shorter thick bracteolate pedicels. *Calyx* a shallow puberulous cup with 4 obscure shallow lobes. *Petals* 4, much longer than the calyx, elliptic, slightly oblique, the apices slightly concave and thickened, the bases truncate, puberulous on both surfaces. *Staminal-tube* slightly shorter than the petals and style, widely cylindric, sparsely puberulous, the mouth with 8 broad 3-toothed lobes. *Anthers* shortly ovate, their apices exserted. *Disc* slightly longer than the ovary, shortly cylindric, fleshy, glabrous, crenulate. *Ovary* hemispheric, densely puberulous, tapering into the thick style. *Stigma* subcapitate, with an annular disc at its base. *Fruit* ovoid, deciduously rusty-puberulous with round smooth pits, the pericarp leathery; length 1·5 to 2 in., diam., ·9 to 1·35 in.

S. Andaman and Nicobar Islands; King's Collectors

This bears, especially in its inflorescence, a resemblance to *D. grande*, Hiern; but this is quite glabrous, while that has leaves very pubescent beneath; the fruit also is different.

Var. *arborea*; 20 feet or more in height, leaves up to 20 in. long, leaflets often much narrowed to the base, longer and with more nerves; spikes often 12 in. long.

16. *DYSOXYLUM MICROBOTRYS*, King n sp. A tree 40 to 60 feet high. *Leaves* 12 to 20 in. long, equally pinnate, their petioles and rachises glabrescent or glabrous; leaflets thinly coriaceous, opposite, about 3 pairs, elliptic or elliptic-oblong, broadly cuspidate, the base cuneate, both surfaces glabrous; main nerves 9 to 11 pairs, oblique, rather straight, slightly prominent beneath when dry; length 6 to 10 in., breadth 2·5 to 3·5 in., petiolules ·25 to ·35 in. *Oymes* spike-like, solitary, extra-axillary, 4 to 8 in. long, few-flowered. *Flowers* ·6 in. long, usually solitary, on pedicels ·15 in. long, bracteolate at the base. *Calyx* a shallow slightly 4-toothed puberulous rugulose cup. *Petals* 4, puberulous, oblong, slightly widened at the base; the apex sub-acute, thickened and incurved. *Staminal-tube* slightly shorter than the petals and style, everywhere puberulous; its mouth not expanded but with many broad shallow obscure teeth. *Anthers* 8, narrowly elliptic, inserted about their own length below the mouth. *Disc* longer than the ovary, tubular, puberulous; the mouth thickened, rugulose, pilose. *Ovary* ovoid-ovoid, pubescent; *style* 4-angled, pubescent in its lower, glabrous in its upper, half; *stigma* discoid, with a narrow annular band at its base, 4-celled, each cell with 2 ovules. *Fruit* pyriform, the top often much flattened, 1·5 to 2 in. long, and from 1·25 to 1·5 in. in diam., sub-glabrous, the pericarp rather thick. *Seeds* about ·75 in. long, plano-convex.

Perak: King's Collector, Nos. 10351, 10580, and probably also No. 10181.

17. *DYSOXYLUM FLAVESCENS*, Hiern in Hook. fil. Fl. Br. Ind. I, 549. A tree. *Leaves* 1 to 2 feet long; leaflets 9 to 13, membranous, alternate, elliptic, oblique, shortly acuminate, glabrous; the base slightly oblique, rounded; main nerves numerous, sub-horizontal, very indistinct on both surfaces, the midrib prominent especially on the lower; length 3 to 5 in., breadth 1.25 to 2 in., petiolules .2 to .25 in. *Spikes* axillary, 2 to 4 in. long. *Flowers* crowded, .35 in. long, sub-sessile, 4-merous, puberulous. *Ovary* very short, nearly flat, 4-toothed, roughly puberulous. *Petals* 4, minutely pilose outside, glabrous inside, slightly imbricated, pale yellow. *Staminal-tube* glabrous below, slightly pilose above, its mouth crenate. *Anthers* 8 or 10, ovate, included. *Disc* glabrous, exceeding the ovary, dull reddish-orange, its mouth entire or undulate. *Ovary* minutely 4-furrowed, hairy, 4-celled; style cylindrical, hairy; *stigma* discoid. C. DC in Mon. Phan. I, 494.

Malacca: Maingay (Kew Distrib.), No. 321.

This is known only by Maingay's scanty and incomplete specimens. The preceding description is largely taken from Maingay and Hiern.

18. *DYSOXYLUM ANDAMANICUM*, King n. sp. A tree 20 to 30 feet high. *Leaves* 6 to 10 in. long, unequally pinnate, the petiole and rachises angled, very pale when dry; leaflets 3 to 5, membranous, alternate, oblong to ovate, slightly oblique, shortly and bluntly acuminate, the base cuneate or rounded, both surfaces glabrous; main nerves 6 to 10 pairs, spreading: length 3 to 5 in., breadth 1.35 to 1.75 in., petiolules .25 in. *Spikes* slightly supra-axillary, 1 to 2 in. long, few-flowered, puberulous. *Flowers* .35 in. long, their pedicels about 2 in., puberulous. *Ovary* a shallow minutely 4-toothed glabrous cup. *Petals* 4, much longer than the calyx and slightly imbricate, oblong, sub-acute, convex at the apex, pale puberulous especially externally, reflexed, rarely deciduous. *Staminal tube* shorter than the petals, widely cylindric, slightly inflated near the base, slightly puberulous, the mouth with 9 or 10 broad crenate teeth. *Stamens* 8 to 10, alternate with the teeth; *anthers* shortly ovate, slightly exserted. *Disc* fleshy, annular, crenulate, shorter than and adherent to the ovary at its base. *Ovary* conic, densely white pubescent, tapering into the stout style; *stigma* included, discoid with a small annulus at its base. *Fruit* depressed-globular, obscurely 8-grooved, glabrous, the pericarp thickly coriaceous, 1.25 in. in diam. *Seeds* 2 or 3, elliptic.

South Andaman: King's Collector.

19. *DYSOXYLUM RUGULOSUM*, King n. sp. A tree 15 to 25 feet high; J. II 7

young branches with striate pale brown bark. *Leaves* 8 to 12 in. long, equally pinnate, the petiole and rachis shorter than the uppermost pair of leaflets; leaflets 2 pairs, the upper pair much the larger, opposite, thickly membranous, pale and minutely rugulose when dry, oblong-oblanco- late, shortly and abruptly acuminate, the base much narrowed; main nerves 8 to 14 pairs, spreading or ascending, faint on the upper surface, prominent and almost winged on the lower: length of the lower pair 3·5 to 4·5 in., breadth about 1·5 in., length of the upper pair 6 to 8 in., breadth about 2·25 in.; petiolules about ·15 in., stout. *Racemes* supra- axillary, ·5 to ·75 in. long, 3- or 4-flowered, puberulous. *Flowers* ·2 in. long, their pedicels shorter. *Calyx* almost flat, 4-cornered, rugulose out- side and puberulous, inside glabrous and reticulate. *Petals* 4, much longer than the calyx, elliptic, puberulous outside, glabrous inside, the apex sub-acute slightly thickened and inflexed, the base truncate. *Staminal tube* shorter than the petals, cylindric, slightly ridged and puberulous outside, glabrous inside, the mouth with 8 or 9 broad shallow emar- ginate teeth; *anthers* elliptic, not exserted. *Disc* shortly cylindric, slightly exceeding the ovary, fleshy, glabrous 8-or 9-toothed. *Ovary* hemispheric, ridged, puberulous, tapering into the long cylindric puberulous style; *stigma* exserted, discoid, with a broad annulus at its base. *Fruit* on a short stout pedicel, pyriform, apiculate, with numerous vertical rugae, puberulous, 1·25 in. long, and ·8 in. in diam. at the broadest part.

Perak: King's Collector, Nos. 2863, 3158, Scortechini.

This resembles *D. macrocarpum*, Bl. in its leaves, but its flowers are much smaller and are in short racemes, not in panicles.

20. *DYSOXYLUM PAPILLOSUM*, King n. sp. A shrub 6 to 8 feet high; young branches rather stout, densely tawny-tomentose. *Leaves* 12 to 18 in. long, equally pinnate, their petioles and rachises tomentose, more or less angled; leaflets 2 or 3 pairs, the upper pair the largest, opposite or sub-opposite, coriaceous, broadly oblanceolate, shortly acumi- nate, tapering from above the middle to the very narrow base; both surfaces when dry minutely papillose, many of the papillae and espe- cially those on the upper surface with perforated apices; the upper sur- face glabrous, olivaceous green when dry; the lower yellowish-brown, the main nerves and midrib pubescent; main nerves 10 to 15 pairs, prominent on the lower, depressed on the upper surface when dry; length 6 to 12 in., breadth 2·25 to ·5 in., petiolules only ·15 in., stout, tomentose. *Spikes* extra-axillary, ·75 to 1·25 in. long, the rachis stout, woody, tomentose. *Flower-buds* globose, ·15 in. in diam., on very short thick pedicels. *Calyx* campanulate, enveloping the petals, 4-toothed, membranous, densely tomentose externally. *Petals* 4, fleshy, broadly

ovate, with truncate bases and sub-acute apices, concave, densely adpressed-pubescent outside, glabrous inside. *Staminal tube* much shorter than the petals, cylindric, rather fleshy, glabrous, the mouth with 8 broad shallow emarginate teeth: *anthers* 8, oblong, longer than the tube, much exerted. *Disc* (if any) very small. *Ovary* broadly ovoid, tapering into the short thick style which is sparsely pilose towards the base: *stigma* thick, discoid, depressed in the centre. *Fruit* unknown.

Perak: King's Collector, No. 10755.

The disc in this plant, if present at all, must be very small, for I cannot detect it in the bud. In spite of this I refer it to *Dysoxylum*, of which it has the general facies. The shrubby habit, short thick spicate inflorescence, globular flower-buds, and the occasionally perforated leaves make this a remarkable and easily recognisable plant.

6. AMOORA, Roxb.

Trees. *Leaves* usually unequally-pinnate; leaflets oblique, quite entire. *Flowers* in axillary subcylindrical panicles, the females sometimes spicate or racemose. *Calyx* 3-5-partite or -fid. *Petals* 3, thick, concave, imbricated. *Staminal tube* sub-globose or campanulate, entire or inconspicuously 6-10-crenate; *anthers* 3-10, included. *Disc* obsolete. *Ovary* sessile, short, 3-celled; cells 1-2-ovuled, stigma sessile. *Capsule* sub-globose, coriaceous, 3-celled and -seeded, loculicidally 3-valved, or indehiscent. *Seeds* in a fleshy aril, with ventral hile.—*DISTRIB.* A genus of about 25 species occurring only in India and the Malay Archipelago, and also 1 endemic species in Australia.

The Indian species of *Amoora*, as this genus is understood by the most recent botanical writers, fall into two groups. One of these (the old genus *Aphanamixis*) is a very natural one. In this group the male flowers are in panicles with divergent racemose or spicate branches, while the female flowers are in short racemes. The flowers of both sexes have a 5-merous calyx, and a 3-merous corolla, 3 or 6 stamens, 3-celled ovaries and 3-celled loculicidally dehiscent capsular fruits. The other group, named *Pseudo-Aglais* by M. O. de Candolle, consists of a number of species with from 6 to 10 stamens, 3-celled-ovaries, and large stigmas. Some of these have 3 petals, others have 4 or 5. As regards fruit some of them (e.g., *A. aculeolata*) have a 3-celled capsule like that of *Aphanamixis*; others have fruits which show no evidence of dehiscence. In treating this genus, I have excluded all the species having more than 3 petals, and I have abandoned dehiscence in the fruit as a diagnostic character. In the note under the genus *Aglais*, I have explained the change which I have made in the staminal character of that genus. I may here add that *Amoora Chittagonga*, Hieron., is certainly an *Aglais*; and that *Amoora decandra*, Hieron., with its 10 anthers in two rows, and 3-celled ovary and fruit, is more of *Lanceium* than an *Amoora*.

Section I. Male flowers in panicles, female flowers in short spikes or racemes, sepals 5, petals 3; fruit 3-celled, capsular, loculicidal.

Stamens 3 1. *A. Sumatrana.*

Stamens 6

Male flowers .15 in. long 2. *A. Rohituka.*

Male flowers .3 in. long 3. *A. Aphanamixis.*

Section II. Male and perfect female flowers mixed in the same panicles: calyx cupular, 3-toothed, petals 3, anthers 6 or 10; fruit 3-celled, but not in all cases dehiscent.

Stamens 6

Leaflets cordate and slightly oblique at the base, minutely rusty-tomentose beneath; flowers .25 in. long ... 4 *A. rubiginosa.*

Leaflets sub-cuneate at the base, minutely puberulous and lepidote beneath; flowers less than .1 in. long ... 5. *A. lanceolata.*

Leaflets sub-falcate and very oblique at the base, everywhere glabrous; flowers .15 in. long, obovoid ... 6. *A. cucullata.*

Leaflets caudate-acuminate, the base rounded or cuneate, oblique, everywhere glabrous: flowers .2 in. long, staminal tube cylindric ... 7. *A. Ridleyi.*

Stamens 10

Panicles 12 to 20 in. long, cinereous-scurfy; leaflets with broad bases: flowers .15 in. long .. 8. *A. Wallichii.*

Panicles 8 to 10 in. long, rusty-puberulous; leaflets narrowed at the base; flowers .1 in. long ... 9. *A. rubescens.*

1. *AMOORA SUMATRANA*, Miq. in Ann. Mus. Lugd. Bat. IV, 83. A tree 12 to 20 feet high; young branches stout, lenticellate, glabrous. *Leaves* 20 to 30 in. long, glabrous, unequally pinnate; leaflets 9 to 13, elliptic to elliptic-oblong, or oblanceolate-oblong, sub-coriaceous, shortly cuspidate, entire, the base more or less cuneate: main nerves 9 to 20 pairs, spreading; length 3 to 10 in., breadth 1.5 to 3.75 in. *Male flowers* .15 in. long, obovoid, in solitary extra-axillary panicles nearly as long as the leaves, their branches 1.5 to 6 in. long, spreading or drooping: the flowers numerous but not crowded, each with a minute acuminate bracteole, the pedicels half as long as the flower, rather stout. *Sepals* 5, unequal, the two larger nearly half as long as the petals, rotund, the edges erose-fimbriate, the inner surface glabrous, the outer pubescent.

Petals 3, thick, rotund, very concave and much imbricate, glabrous inside, sometimes puberulous outside. *Staminal column* fleshy, globular-ovoid, obscurely 3-angled, the mouth almost closed; *anthers* 3, broadly elliptic, narrowed to the apex, shortly apiculate; rudimentary ovary minute, conical, on a small pubescent disc. *Female flowers* unknown; the fruit in simple spikes as long as or longer than the leaves, pinkish when ripe, shortly pedicellate, sub-globular, 3-celled, 3-seeded, dehiscent, about .75 in. in diam.; the seeds ovoid, compressed, with a scarlet arillus. C. DC. Monogr. Phaner. I., 581.

Perak: Scortechini, Wray, King's Collector. Penang: Curtis, King. Distrib. Sumatra

This species resembles *A. Rohituka*, W. and A., but it is a smaller tree, the male flowers have only 3 stamens, and the petals are pink. The Perak specimens agree with those in the Leiden Herbarium from Sumatra on which Miquel founded the species. Miquel in his description does not mention that the plant is triandrous,—a character by which it can at once be recognised

2 *AMORA ROHITUKA*, W. and A. Prod. 119. A tree from 30 to 70 feet high, young branches stout, lenticellate, at first puberulous, afterwards glabrous. *Leaves* 1 to 3 feet long, unequally pinnate, the petioles puberulous; leaflets 9 to 15, sub-coriaceous, opposite, oblong to elliptic-oblong, shortly and bluntly acuminate, entire; the base narrowed, often oblique, both surfaces glabrous: main nerves 12 to 18 pairs, spreading; length 3 to 9 in., breadth 1.75 to 3.5 in., petiolule .2 to .3 in. *Male flowers* about .15 in. long, sub-globular, in solitary axillary panicles more than half as long as the leaves, the branches about 3 in. long, spreading at right angles or slightly drooping; the flowers numerous, each with a minute scale-like bract, the pedicels short, stout, *Oalyx* very short, spreading, with 5 or 6 small reniform sepals, pubescent. *Petals* 3, much larger than the calyx, orbicular, concave, glabrous or puberulous on the outer surface. *Staminal tube* nearly as long as the petals, sub-globular, with a small opening at the apex showing the slightly protruding apices of the anthers: *anthers* 6, sub-sessile, narrowly elliptic, attached to the tube near its base; rudimentary ovary ellipsoid, boldly 3-angled. *Female flowers* larger than the males, in axillary or slightly supra-axillary, solitary, often puberulous spikes much shorter than the leaves. *Sepals* sometimes more pubescent than in the male: petals as in the male, the anthers narrower. *Ovary* sub-globular or ellipsoid with a 3-lobed stigma: disc hypogynous, broadly conical, tawny-pubescent. *Fruit* sub-globular, yellow when ripe, 1 to 1.5 in. in diam.; the pericarp coriaceous, smooth, 3-celled, opening by 3 valves: seed oblong with a scarlet arillus. Hiern in Hook. fil. Fl.

Br. Ind. I, 559; C. DC. Monogr. Phan. I, 581; Kurz For. Flor. Burma I, 220; Trimen Flor. Ceyl. I, 249; Bedd. Fl. Sylvat. t. 132; Brandis For. Fl. 69. *Andersonia Rohituka*, Roxb. Hort. Beng. 87; Fl. Ind. ii, 213. *Sphaerosome polystachya*, Wall. Cat. 1277. *Aglaia*? *polystachya*, Wall. in Roxb. Fl. Ind. ed. Carey, ii. 429. *S. spicata*, Wall. Cat. 4895. *Buchanania spicata*, Hb. Roxb. ex Wall. l. c. *Meliacea Wightiana* Wall. Cat. 4833. *Amoora macrophylla*, Nimmo in Grah. Cat. Bomb. Pl. 31. *Andersonia Rohitoca*, Griff. Notul. iv. 507; Ic. Pl. Asiat. iv. t. 589, f. 3.

Perak: not uncommon. Malacca; Griffith (Kew Distrib.) 1051; Maingay (Kew Distrib.) 341; King's Collector, many numbers. Andamans; King's Collector. Distrib. Sumatra; Forbes, No. 1734.

3. *AMOORA APHANAMIXIS*, Schultes fil. Syst. VII, 1621, Phan. I, 581. A tree 20 to 30 feet high; young branches rusty puberulous, ultimately glabrous and (when dry) black. Leaves 15 to 25 in. long, unequally pinnate; leaflets 11 to 17, sub-coriaceous, oblong, oblong-obovate to elliptic, shortly and obtusely cuspidate; the base rounded, very unequal-sided; glabrous when adult; main nerves 10 to 12 pairs, slightly prominent beneath; length 4 to 6 or even 8 in., breadth 2 to 2.75 in.; petiolules stout, .15 to .25 in. long. Panicles slightly supra-axillary, shorter than the leaves, puberulous, those with male flowers with numerous short divaricating rather distantly-flowered racemose branches. Flowers on very short pedicels, sub-globose, about .25 in. in diam. Ovary cupular, with 5 rounded imbricate sepals, thickened in the lower half and puberulous outside. Petals 3, thick, rotund, concave, much larger than the sepals, glabrous. Staminal tube shorter than the petals, fleshy, glabrous, ovoid, with a small entire mouth; anthers 6, elliptic, included. Ovary depressed, 3-celled, glabrous; stigma elongate, conical, flat. Female flowers in rigid, unbranched or only slightly branched racemes, sessile like the males but with larger ovaries. Fruit ovoid-globose (ripe example not seen), glabrous. Miq. Fl. Ind. Bat. I, pt. 2. p. 535: Ann. Mus. Lugd. Bat. IV, 34. *Amoora grandifolia*, C. DC. Monogr. Phan. I, 581. *Aphanamixis grandifolia*, Bl. Bijdr. 165.

Under cultivation the leaves of this species often attain much greater size than the measurements given above.

4. *AMOORA RUBIGINOSA*, Hiern in Hook. fil. Fl. Br. Ind. I, 561. A tree 80 to 100 feet high; young branches stout, rusty-puberulous and scurfy. Leaves 18 to 24 in. long, equally pinnate; leaflets 8 to 10 pairs, opposite or alternate, coriaceous, oblong or elliptic-oblong, sub-acute or shortly acuminate, the base cordate and slightly oblique; upper surface glabrous, shining, the lower densely covered by minute rusty

tomentum with a few superficial stellate hairs; main nerves 20 to 24 pairs, spreading, prominent beneath; length 5 to 9 in., breadth 1.25 to 2.75 in.; petiolules about .15 in. long, bent. *Panicles* solitary, axillary, more than half as long as the leaves, scurfily rusty-puberulous, the peduncles long, branches few with short racemose-branchlets. *Flowers* on short pedicels, buds narrowly ovoid, .25 in. long. *Calyx* shortly campanulate, rusty-tomentose outside, with 3 broad blunt spreading teeth. *Petals* 3, larger than the calyx, obovate-rotund, thick, glabrous. *Staminal tube* slightly shorter than the petals, narrowly ovoid, the mouth narrow and obscurely toothed; *anthers* 6, elliptic, included. *Ovary* broadly ovoid, depressed, 3-angled, tawny-pubescent, crowned by the glabrous ovoid, 6-angled stigma. *Fruit* sub-globose, apiculate, red when ripe, rusty-puberulous, 2 to 3 in. in diam., the pericarp pulpy. *Seeds* narrowly ellipsoid, about 1 in. long. C. DC. Monogr. Phan. I, 585. *Aphanamix rubiginosa*, Griff. MSS.

Malacca, Griffith, No. 1050; Maingay, No. 340 (both of Kew Distrib.). Perak: King's Collector Singapore, Ridley, No. 8790.

5. *AMOORA LANCEOLATA*, Hiern in Hook. fil. Fl. Br. Ind. I, 560. A tree, young shoots minutely rusty-puberulous. *Leaves* 6 to 10 in. long, unequally pinnate. *Leaflets* about 17, sub-coriaceous, opposite or nearly so, narrowly oblong-lanceolate, bluntly acuminate, entire, the base sub-cuneate; upper surface quite glabrous, the lower very minutely puberulous and lepidote; main nerves very faint, about 25 pairs, spreading; length 2 to 3 in., breadth .6 to .75 in., petiole .2 in. *Panicles* of *male flowers* axillary, solitary, nearly as long as the leaves, the branches spreading, 1.25 to 2 in. long, many-flowered. *Male flowers* less than .1 in. long, ovoid, on very short pubescent pedicels. *Calyx* cupular, with 3 shallow teeth, pubescent. *Corolla* much larger than the calyx; *petals* 3, concave, glabrous inside, puberulous outside. *Staminal tube* shorter than the *petals*, globular, glabrous, the mouth deeply 6-toothed; *anthers* 6, included, opposite the teeth, narrowly-elliptic; rudimentary. *Ovary* conical, 3-angled, puberulous. *Female flowers* and fruit unknown. C. DC. in Monogr. Phan. I, 584.

Malacca; Maingay (Kew Distrib.), No. 343.

6. *AMOORA CUCULLATA*, Roxb. Corom. Pl. III, 54, t. 258. A glabrous tree 30 to 40 feet high. *Leaves* 12 to 15 in. long, unequally pinnate; *leaflets* 5 to 9, thinly coriaceous, opposite, oblong-elliptic, sub-falcate, sub-acute, very oblique at the base: main nerves indistinct, numerous, spreading, the midrib strong; length 3 to 5 in., breadth 1.2 to 1.5 in., petiolule .3 in. *Male panicles* about equal to the leaves, axillary, with lax, spreading, corymbiform, sparsely lepidote branches. *Flowers* .15 in. long, obovoid. *Calyx* cupular, lepidote outside, with 3 broad blunt

teeth. *Petals* 3, longer than the calyx, glabrous, broadly elliptic, the apex blunt and concave. *Staminal tube* shorter than the petals, obovoid, its mouth with 6 shallow broad blunt erose teeth; *anthers* 6, elliptic, included, attached half-way up the tube; *rudimentary ovary* broadly ovoid, sub-truncate. *Female flowers* a little larger than the males, but in few-flowered supra-axillary racemes about 2 in. long; *Calyx*, corolla, staminal tube and anthers as in the male; *ovary* ovate, 3-angled, lepidote, 3-celled: stigma sessile, large, 3-lobed. *Fruit* depressed-globular, 2·5 in. in diam., dehiscent by 3 valves, the pericarp leathery. *Seeds* 3, rounded trigonous, with an orange-coloured arillus. Kurz For. Flora Burma I, 221; C. DC. Monogr. Phan. I, 583; *Hiern in Hook. fl. Fl. Br. Ind. I, 560; Bedd. Fl. Sylv. 55; Miq. Ann. Mus. Lugd. Bat. IV, 37; Dalz. and Gibs. Fl. Bomb. 87. *Andersonia curculata*, Roxb. Hort. Beng. 82; Fl. Ind. II, 212. *Sphaerosacme Rohituku*, Wall. Cat. 1278. *Amoora auriculata*, Miq. MSS.

Perak: Scortechini Singapore: Ridley. Distrib. Borneo, Korthals: Burma, Khasia Hills, Delta of Ganges, Nepal.

7. *AMOORA RIDLEYI*, King n. sp. A tree 50 to 60 feet high; young branches stout, minutely cinereous-puberulous. *Leaves* 18 to 24 in. long, unequally pinnate; leaflets 11 to 17, sub-opposite or opposite, sub-coriaceous, oblong-lanceolate to ovate-lanceolate, caudate-acuminate; the base rounded or cuneate, very unequal; both surfaces glabrous, the lower sub-glabrous; main nerves 8 to 13 pairs, spreading, slightly prominent on the lower surface: length 3·5 to 6 in., breadth 1·35 to 2 in., petiolules ·25 to ·4 in. *Panicles* axillary, solitary, about half as long as the leaves, stellate-pubescent, on long peduncles, much branched, the ultimate branchlets cymulose. *Flowers* 2 in. long, narrowly ovoid, on bracteolate pedicels nearly as long as themselves. *Calyx* rather deeply cupular, tomentose outside, the mouth with 3 shallow broad teeth. *Petals* 3, longer than the calyx, fleshy, broadly elliptic, with very concave blunt apices, pubescent in the lower half outside, otherwise glabrous. *Staminal tube* much shorter than the petals, glabrous outside, with a few scattered hairs inside, cylindric, with a wide mouth with 6 broad shallow teeth; *anthers* 6, narrowly elliptic, their apices exserted; *ovary* depressed, densely pubescent, 3-celled; *stigma* glabrous, large, pyramidal, deeply grooved. *Fruit* globular, minutely rusty-tomentose, 2·5 in. in diam. when ripe, indehiscent, usually with 2 seeds 1·75 in. in length; peduncle, stout, ·5 in. long.

Perak: King's Collector, Nos. 5383, 5918, 6060, 7917; Wray, No. 2107. Pahang: Ridley, No. 5027

8. *AMOORA WALLICHII*, King. A tree: young branches stout, minutely rusty-puberulous. *Leaves* 15 to 24 in. long, unequally pinnate:

leaflets 11 to 13, sub-coriaceous, opposite or sub-opposite, narrowly oblong, sub-acute, the base rounded or slightly cuneate, slightly oblique; both surfaces glabrous: main nerves 16 to 18 pairs, prominent on the rather pale under surface: length 4·5 to 8 in., breadth 1·4 to 2 in., petiole .5 in. *Panicles* solitary, axillary, nearly as long as the leaves, with few rather distant lax alternate branches, the ultimate branchlets cymulose and slightly scurfy. *Flowers* .15 in. long, sub-rotund. *Calyx* a flat-tish cup with 3 broad shallow teeth, minutely tomentose externally. *Petals* 3, longer than the calyx, rotund, concave, much imbricate, minutely pubescent outside. *Staminal tube* spherical-obovoid, with 10 small acute teeth, glabrous; anthers 10, narrowly elliptic, their apices slightly exerted: rudimentary ovary depressed, tawny-pubescent, crowned by the thick fleshy 3-grooved stigma. *Female flowers* mixed with the males and exactly like them, but with a pyramidal, prominently 3-angled, tawny-pubescent, 3-celled ovary crowned by a stigma as in the male. *Fruit* obovoid, about 2 in. in diam., on a stout peduncle, its surface tawny-tomentose. *Sphaerosacme spectabilis*, Wall. MSS. in Herb. Calo. *Amoora spectabilis* Hiern (not of Miquel) in Hook. fil. Fl. Br. Ind. I, 561. Kurz For. Flora Burma I, 221.

Andaman Islands, King's Collectors. Distrib. Burma, Assam, Sikkim.

There has been some confusion in dealing with this plant. The description above given is that of Wallich's own specimen (in flower) taken from a tree grown in the Bot. Gard., Calcutta, which had originally been brought from Goalpara in Assam. Fruiting specimens have in more recent years been collected in Assam by Mr. Gustav Mann, for many years Conservator of Forests in that province. Flowering specimens exactly agreeing with Wallich's have also been brought from the Andaman Islands. Miquel has described (Ann. Mus. Lugd. Bat. IV, 37) under the name *Amoora spectabilis*, a plant of which he says *Sphaerosacme spectabilis*, Wall. is the type. But Miquel's description does not fit Wallich's plant at all. Mr. Hiern, taking Miquel's name *A. spectabilis*, describes under it a plant from Burmah which is certainly not Miquel's plant: but which may be the same as *Sphaerosacme spectabilis*, Wall.

9. *AMOORA RUBESCENS*, Hiern in Hook. fil. Fl. Br. Ind. I, 561. A tree 30 to 40 feet high; young branches stout, rusty puberulous. *Leaves* 18 to 30 in. long: leaflets 13 to 15, opposite, thinly coriaceous, oblong, sub-acute or obtuse, narrowed and oblique at the base, both surfaces glabrous; main nerves 8 to 10 pairs, ascending, rather prominent beneath; length 4 to 5·5 in., breadth 1·75 to 2·25 in., petiole .5 in. *Panicles* solitary, axillary, 8 to 10 in. long, rusty puberulous, the

branches spreading, the ultimate branchlets 2- to 3-flowered. *Flowers* on short pedicels, obovoid-rotund, $\frac{1}{2}$ in. long. *Calyx* cupular, puberulous outside, with 8 broad blunt teeth. *Petals* 3, longer than the calyx, rotund, concave, slightly puberulous on the back and edges. *Staminal tube* broadly ovoid, the mouth wide and with 9 broad bifid teeth; *anthers* 10, elliptic, their apices exserted. *Ovary* depressed, tawny-pubescent, 3-celled: stigma large, cylindric, glabrous, sulcate. *Fruit* depressed-globular, mammillate, 2 in. in diam., minutely rusty puberulous, 3-celled (one cell abortive), pericarp thickly coriaceous, almost fleshy. C. DC. Monog. Phan. I, 589.

Singapore: Maingay Herb. prop. No. 3351 (Kew Distrib. No. 355). Perak: King's Collector, No. 5944; Wray, No. 2349. Penang: Curtis No. 2437.

The fruit when ripe is reddish-brown, according to Mr. Curtis.

7. *AGLAIA*, Lour.

Trees or shrubs, glabrous, lepidote or stellately pubescent. *Leaves* pinnate or trifoliate; leaflets quite entire. *Flowers* polygamo-dioecious, minute or small, numerous, paniculate, sub-globose. *Calyx* 5-lobed, imbricated in bud. *Petals* 5, concave, short, imbricated. *Staminal tube* urceolate or sub-globose, 5-toothed at the apex or entire; anthers usually 5, or 4 or 10, included or half-exserted, erect. *Disk* inconspicuous. *Ovary* ovoid or shortly so, 1-3-celled, with 2-1 ovules in each cell; style glabrous, short. *Berry* dry, 1-2-celled and-seeded. *Seeds* with a fleshy integument.—DISTRIB. Species about 70, Chinese, Indo-Malayan or Polynesian.

The genus *Aglaiia* is distinguished by its small flowers with 5-merous calyx and corolla, and depressed-globose or globose staminal tube. The calyx-lobes are often imbricate, and the petals are invariably so, three being outside or partly so, and two entirely covered by the outer three. To the genus, as limited by M. C. de Candolle and Mr. Hiern, only species of which the anthers are either 5 or 6 can be admitted. The effect of this limitation as to the number of the anthers is to force into *Amoora* various species which, taking the section *Aphanamisis* as the type of *Amoora*, have far less in common with that genus than with the 5-antherous species of *Aglaiia*. The result, as regards *Amoora*, is that that genus is loaded with a number of anomalous species collected together in a group under the sectional name *Pseudo-Aglaiia*. By relaxing the definition of *Aglaiia* so as to admit plants of which the flowers have 4, 8 or 10 stamens, and by limiting *Amoora* to plants with 3-merous corollas, it appears to me that both genera are greatly simplified. Dehiscence in the fruit cannot be regarded as a diagnostic character of *Amoora*, there being several Indian species in the fruit of which there is no evidence of dehiscence; but indehiscence in the fruit is an absolute character in *Aglaiia*. The effect of the change which I have ventured to carry into effect in the diagnoses of these two genera is, as regards the species described by Mr. Hiern in the *Flora of British*

India, to convert *Amoora Maingayi* Hiern into an *Aglais*: *Amoora dysanthyoides*, Kunt is also removed to this genus.

STAMENS 4 1. *A. fusca*.

STAMENS 5

Leaves quite glabrous, and not lepidote on the lower surface.

Leaves trifoliolate, 2·5 to 3 in. long, often shorter than the panicles; calyx with elliptic lobes: anthers elliptic, included... 2. *A. odorata*.

Leaves 3- to 5-foliolate, 5 to 9 in. long, always longer than the panicles; calyx with rounded teeth, puberulous outside; anthers broadly ovate and with the tips exerted... 3. *A. oligophylla*.

Leaves 5 to 8 in. long; leaflets 5 or more; all parts of the flower glabrous *A. glabriflora*.

Leaves 7 or 8 in. long, leaflets 5 to 8, subglaucous beneath; sepals free, pubescent outside, flowers ovoid, 1 in. long 5. *A. glaucescens*.

Leaves 6 to 12 in. long, leaflets 7 to 9, the calyx toothed, lepidote-pubescent outside; flowers depressed-hemispheric, 0·5 in. in diam. 6. *A. Scortechinii*.

Leaves 12 to 24 in. long; leaflets about 15, brown when dry; calyx toothed, puberulous; flowers obovate, 1·5 in. long 7. *A. Ganggo*.

Leaves 18 to 36 in. long; leaflets 11 to 13, pale when dry; calyx puberulous; flowers 0·5 to 0·75 in. in diam., depressed-globular 8. *A. leucophylla*.

Leaflets glabrous above, lepidote but not pubescent on the lower surface.

Flowers depressed-globular, not more than 0·4 in. in diam., on pedicels as long as or longer than themselves.

Calyx with 4 or 5 long spreading unequal teeth nearly as long as the petals 9. *A. cinerea*.

Calyx with 5 orbicular blunt spreading lobes much shorter than the petals ... 10. *A. odoratissima*.

Flowers ovoid or obovoid-globose, 0·5 in. or more in diam., on pedicels shorter than themselves.

- Flowers ovoid, .08 in. long; calyx sub-campanulate, densely pubescent outside with 5 deep broadly ovate lobes; scales on under surface of leaflets minute and not shining 11. *A. Forbesii*.
- Flowers ovoid, .05 in. long; calyx cupular, pale-coloured, almost glabrous, divided to the base into 5 shallow broad blunt lobes; scales on lower surface of leaflets shining 12. *A. squamulosa*.
- Flowers obovoid-globose, .08 in. long; calyx with 5 broad shallow rounded spreading lobes minutely whitish tomentose with superficial stellate-hairy bright rusty scales; scales on lower surface of leaflets sparse stellate-hairy ... 13. *A. Kunthii*.
- Leaflets more or less glabrous on the upper, pubescent on the lower surface.*
- Panicles small with very short few-flowered branches 14. *A. humilis*.
- Panicles condensed; flowers densely crowded, sessile.
- Leaflets on the under surface covered with minute tomentum with stellate hairs intermixed, and with superficial shining scales; flowers sub-globular, petals orbicular 15. *A. argentea*.
- Leaflets as in *A. argentea*, petals elliptic, flowers ovoid 15. *A. argentea*.
var. Curtisii.
- Leaflets tomentose on the lower surface, scales if any not shining; petals elliptic, flowers ovoid 15. *A. argentea*.
var. eximia.
- Panicles not condensed, their main branches spreading, the ultimate divisions short densely flowered spikes; flowers depressed-globular, sessile.
- Flowers .1 in. in diam.,
- Main nerves of leaves 28 to 36 pairs:
- panicles 9 to 12 in. long 16. *A. lanuginosa*.
- Main nerves of leaves 16 to 24 pairs;
- panicles 6 to 8 in. long 17. *A. Curtisii*.

Flowers .025 to .4 in. in diam.

Calyx very tomentose and with 5 long narrow acute or sub-acute spreading unequal lobes some of them longer than the petals.

Leaves 4 to 9 in. long: leaflets not cordate at the base, 1.5 to 5 in. long; main nerves 6 to 11 pairs, spreading, fruit ellipsoid ... 18.

A. Palembangica.

Leaves 7 to 15 in. long; leaflets minutely cordate at the base, 4 to 6 in. long; main nerves 10 to 14 in., oblique: fruit globular or ovoid .. 19

A. cordata.

Calyx much shorter than the petals and with broad short imbricate lobes.

Calyx quite glabrous ... 20.

A. Hiernii.

Calyx pubescent outside; fruit pyriform, 1.75 in. long ... 21.

A. Griffithii.

Panicles lax, spreading; flowers not crowded, depressed-globular, globular or obovoid, sub-sessile or pedicelled.

Flowers sub-sessile, anthers exserted.

Flowers .035 in. in diam., depressed-globular, sub-sessile: calyx rotate and with 5 deep broad rounded membranous pubescent lobes: staminal tube short, cupular, sub-entire, glabrous. Fruit ovoid-globose, tapering into a pseudo-stalk, 1 in. long ... 22.

A. membranifolia.

Flowers pedicelled, anthers included.

Flowers .05 in. long, globular, on pedicels longer than themselves. Calyx cupular with 5 acute spreading teeth stellate-pubescent outside. Staminal tube globular, inflated about the middle, glabrous, the mouth sub-entire: fruit obovoid, rugulose, about .4 in. long ... 23.

A. tenuicaulis.

Flowers .06 in. long, obovoid, on pedicels shorter than themselves; Calyx cupular, pubescent outside, with 5 blunt-rotund spreading lobes; staminal

tube obovoid, 5-toothed, puberulous;

fruit globular to ovoid, .4 to .6 in.

long 24. *A. trichostemon*.

STAMENS 7 to 9.

Panicles 12 in long: calyx with 4 broad

valvate unequal teeth; stigma long, nar-

row, deeply 3-grooved, ovary 3-celled ... 25. *A. macrostigma*.

Panicles 2.5 to 6 in. long.

Calyx fleshy, pellucid-dotted, with 5

broad imbricate lobes: stigma thick,

cylindric, 2-lobed; ovary 2-celled ... 26. *A. heteroclita*.

Calyx with 5 minute erect pointed teeth:

stigma capitate, 2-3-angled ... 27. *A. andamanica*.

STAMENS 10 28. *A. Maingayi*.

1. *AGLAIA FUSCA*, n. sp. King. A tree, young branches cinereous, at first covered with a thin layer of deciduous minute pale rusty scurfy tomentum, afterwards glaberrulous. *Leaves* 6 to 10 in. long, equally or unequally pinnate; leaflets coriaceous, alternate, sub-opposite (the upper pair opposite) oblong-lanceolate to ovate-lanceolate, shortly acuminate or acute, the base cuneate or sometimes rounded; upper surface glabrous and shining; the lower glabrous, minutely punctulate, the midrib rusty-puberulous; main nerves 7 to 9 pairs, ascending; length 2.5 to 4.5 in., breadth 1 to 1.75 in.; petiolules .35 in., that of the odd leaf (when present) longer. *Panicles* axillary, solitary, much shorter than the leaves, with rather long peduncles, the branches few, the flowers rather crowded. *Flowers* globular, .05 in. in diam., on pedicels rather shorter than themselves. *Calyx* of 4 unequal rotund sepals, scaly externally. *Petals* 4, rotund, concave, glabrous, larger than the sepals. *Staminal tube* globular-obovoid, much thickened inside below each anther, glabrous, the mouth small annular, sub-entire; *anthers* 4, shortly and thickly ovate, inserted near the mouth. *Ovary* (rudimentary) pubescent; *stigma* long, cylindric, glabrous. *Fruit* globular with a small apiculus, minutely rusty-tomentose, .3 in. in diam. (not ripe), one-celled and one-seeded by abortion.

South Andaman: King's Collector.

In the fruit distinct remains of a second cell are found. The species is closely allied to *A. fuscescens*, but is distinguishable by its thicker narrower leaflets with midribs hairy below, much smaller flowers, and more globose staminal tube which appears never to have more than 4 anthers. Flowers with perfect pistils have not yet been found.

2. *AGLAIA ODORATA*, Lour. Fl. Coch. Chin. 173. A shrub or small tree; young shoots slender, rusty stellate-lepidote. *Leaves* trifoliate, 2.5 to 5 in. long; leaflets thinly coriaceous, ovate- or obovate-oblong, the

apex obtuse or tapered to each end or sub-rhomboidal: the terminal one the largest and tapering into the petiole: both surfaces glabrous, minutely reticulate when dry: main nerves 6 to 8 pairs, curving, indistinct; length of lateral pair 1.25 to 2 in., of terminal one 2.5 to 3.5 in. *Panicles* often longer than the leaves, lax. *Flowers* .1 in. long, on pedicels of about the same length, glabrous. *Calyx* with 5 deep elliptic lobes. *Petals* unequal, orbicular or sub-orbicular. *Staminal tube* [campanulate, with 5 broad truncate teeth; *anthers* 5, elliptic, included. *Fruit* unknown.

Malacca, Penang and Singapore: but probably only cultivated. Distrib. China and Siam.

3. *AGLAIA OLIGOPHYLLA*, Miq. Fl. Ind. Bat. Suppl. 507. A small tree 15 to 20 feet high: young branches covered with deciduous cinereous scurf. *Leaves* 5 to 9 in. long, unequally pinnate, the petioles and rachises puberulous, soon becoming glabrous; leaflets 3 to 5, membranous, the pairs opposite, the terminal one the largest, obovate-oblong to elliptic, shortly and often bluntly acuminate, the base cuneate, sometimes oblique: both surfaces glabrous, reticulate when dry; main nerves 5 or 6 pairs, ascending, curving; length 3 to 6 in., breadth 1.5 to 2.5 in.; petiolules .4 to .5 in., swollen at the base. *Panicles* axillary, 1.5 to 4 in. long, at first scurfy, but ultimately sub-glabrous, much branched, bracteolate. *Flowers* .075 in., in diam., on slender pedicels as long as themselves, globular. *Calyx* cupular, flat, with 5 spreading rounded concave teeth, puberulous externally, the edges ciliate. *Petals* much longer than the calyx, orbicular, concave, glabrous. *Staminal tube* shorter than the petals, globular-turbinate, 5-grooved, the mouth with 5 broad blunt teeth; *anthers* 5, broadly ovate, the tips only exerted. *Ovary* depressed; *stigma* conical, pubescent. *Fruit* globular, with the calyx persistent at its base, densely and minutely tawny-pubescent, .5 or .6 in. in diam.; the pedicels stout, glabrous .1 in. long. Kurz For. Flora Burma I, 220; C. DC. Monogr. Phaner. I, 607; Miq. Ann. Mus. Lugd. Bat. IV, 41. *Meliaceae Singapuriana?* *Walsura* Wall. Cat. 4887.

Singapore: Wallich. Perak: King's Collector, No. 3968. Distrib. Burmah, Helfer (Kew Distrib.), No. 1046. Sumatra.

4. *AGLAIA GLABRIFLORA*, Hiern in Hook. fil. Fl. Br. Ind. 1. 555. A glabrous tree 15 to 25 feet high. *Leaves* 5 to 8 in. long, unequally pinnate, the petioles and rachises angled: leaflets about 8 opposite and one odd, membranous, usually ovate, rarely lanceolate, bluntly acuminate, the base cuneate, rarely rounded; when dry the upper surface shining, the lower dull; main nerves 4 pairs, ascending, curving, obsolete on the upper, slightly prominent on the lower surface; length 2 to 2.75 in., breadth .75 to 1.25 in., petiolules .15 to .2 in. *Panicles* solitary, axillary, spreading, 1.5 to 4 in. long. *Flowers* numerous, .1 in. long, their

pedicels usually shorter but sometimes longer than themselves. *Calyx* cupular, fleshy, with 5 broad shallow rounded teeth. *Petals* 5, much longer than the calyx, ovate, concave, the edges thin. *Staminal tube* shorter than the petals, urceolate, the edge sub-entire; *anthers* 5, elliptic, subcordate, deeply included. *Ovary* short, depressed, pubescent; *stigma* long, cylindric, glabrous. *Fruit* reniform, compressed, cinereous, puberulous, 2-celled, 2-seeded, .6 in. in diam. C. DC. Monogr. Phaner. I, 608.

Malacca: Griffith, Nos. 1041, 1042. Maingay (Kew Distrib.) No. 336. Perak: King's Collector, Nos. 10617, 10724. Scortechini, No. 482. Singapore: Ridley, Nos. 1812, 3898.

5. *AGLAIA GLAUDESCENS*, n. sp. King. A shrub: young branches rather slender, the bark when dry cinereous lenticellate; while young covered with pale rusty minute scurfy tomentum. *Leaves* 7 or 8 in. long, equally or unequally pinnate: leaflets 5 to 8, thinly coriaceous, oblong or elliptic-oblong or obovate-oblong, sub-acute, the base cuneate, both surfaces glabrous, the upper shining, the lower dull and sub-glaucous; main nerves 8 to 10 pairs, ascending, rather straight, slightly prominent on the lower surface; length 3.5 to 5.5 in., breadth 1.75 to 2 in. (rarely 3 in.), petiolules .35 to .5 in. *Panicles* solitary, axillary, nearly as long as the leaves, branching from near the base, very lax, few-flowered. *Flowers* ovoid, .1 in., long, on pedicels about as long as themselves. *Calyx* of 4 or 5 ovate concave ascending sepals, pubescent externally. *Petals* 4 or 5, larger than the sepals, thick, elliptic, obtuse, glabrous. *Staminal tube* nearly as long as the petals, cylindric, widening at the sub-entire mouth; *anthers* 4 or 5, shortly and broadly ovate, attached near the apex of the tube, included. *Ovary* shortly and narrowly cylindric, pubescent, crowned by the glabrous cylindric stigma. *Fruit* unknown.

South Andaman Island: King's Collectors.

6. *AGLAIA SCORTECHINII*, King, n. sp. A tree; young shoots slender and, like the slender petioles, rachises, petiolules and inflorescences, with very minute brown scales. *Leaves* 6 to 12 in. long, unequally pinnate; leaflets 7 to 9, the pairs opposite, membranous, lanceolate or oblong-lanceolate, shortly acuminate, much cuneate at the base; both surfaces quite glabrous, pale brown when dry; the 7 to 10 pairs of main nerves indistinct; length 3.5 to 5 in. *Panicles* 7 to 9 in., the branches long, divaricating, lax. *Flowers* depressed-hemispheric, .05 in. in diam., on slender pedicels longer than themselves. *Calyx* short, spreading, with 5 deep orbicular concave lobes, lepidote-pubescent externally. *Petals* 5, orbicular or ovate-orbicular, concave, glabrous, much larger than the calyx. *Staminal tube* shorter than the petals, widely depressed-campulate, the mouth with several broad much inflexed teeth, glabrous;

anthers 5, elliptic, included. Ovary small, depressed; stigma globose. Fruit unknown.

Perak: Scortechini, No. 722.

The nearest ally of this is *A. speciosa*, Blume, which, however, has leaflets of thicker texture, with more numerous and distinct nerves and squamulose on the under surface. The flowers of the two also differ slightly, those of *A. speciosa*, although similar in calyx and corolla, having a staminal tube with a wide open mouth, without inflexed teeth and from which the anthers are partly exerted.

7. *AGLAIA GANGGO*, Miq. Flor. Ind. Bat. Suppl. 506. A tree: young branches, petioles, midribs and inflorescences covered with minute rusty scales. Leaves 10 to 24 in. long, equally or unequally pinnate; leaflets 10 to 15, opposite or alternate, sub-coriaceous, narrowly oblong or oblong-lanceolate, shortly and rather abruptly acuminate; the base cuneate, unequal-sided: both surfaces free from hairs, but covered with very minute scale-like pustules: main nerves 12 to 18 pairs, faint, spreading: length 3 to 5.5 in., breadth 1 to 1.75 in., petiolule .15 to .35 in. Panicles solitary, axillary, nearly as long as the leaves, the lower branches distant, all more or less spreading, the flowers on the ultimate branchlets rather crowded. Flowers .1 to .15 in. long, ovoid, sub-sessile. Calyx cupular, minutely pubescent and scaly outside, the mouth with 5 broad blunt erect teeth. Petals 5, larger than the calyx, elliptic, concave, blunt, glabrous. Staminal tube shorter than the petals, ovoid, the mouth small, circular, not toothed; anthers 5, narrowly elliptic, included. Ovary small, depressed, 3-angled, densely hairy, crowned by the glabrous cylindric grooved stigma. Fruits on short stout pedicels, reniform, compressed, 2-celled, 2-seeded, minutely rusty-lepidote, .5 in broad (perhaps not quite ripe). Miq. Ann. Mus. Lugd. Bat. IV, 47. C. DC. Phaner. Monogr. I, 27.

South Andaman, Nicobar Islands; King's Collector. Distrib. Sumatra.

The flowers of the Andaman specimens agree exactly with those from Sumatra on which Miquel founded the species which is a very distinct one. On each panicle, there appear to be certain flowers with perfect and others with imperfect ovaries. The panicles bearing fruit are thus in size and ramification exactly like those bearing flowers. *A. Forrestii*, a species founded by Miquel (Ann. Mus. Lugd. Bat. IV, 46) on specimens collected in Amboina does not appear to me to be really distinct from this. Under the name of *Aglaiia Ganggo*, Miq., I believe there have been issued from the Calcutta Herbarium some specimens of a Perak plant (King's Collector, No. 4606), which much resembles this in leaves and inflorescence, but which has a very different staminal tube.

8. *AGLAIA LEUCOPHYLLA*, King, n. sp. A tree 40 to 60 feet high; all parts quite glabrous; young branches rather stout, pale, cinereous when dry and slightly rough. *Leaves* 2 to 3 feet long, unequally pinnate; the petioles very long, minutely rugulose when dry; leaflets 11 to 13, membranous, the lower alternate and distant, the upper opposite, oblong-lanceolate to elliptic-oblong or ovate, all with acuminate apices and cuneate bases, the lower half sometimes very narrow; main nerves 9 to 15 pairs, spreading, curving, invisible on the upper but distinct on the lower surface; length 6 to 12 in., breadth 1·25 to 3 in.; petiolules ·25 to ·6 in., slender. *Panicles* extra-axillary, slender, rugulose, the branches spreading but slightly. *Flowers* ·05 to ·075 in. in diam., depressed-globular, on pedicels longer than themselves. *Calyx* much smaller than the petals, pale-coloured, puberulous, with 5 deep acute or sub-acute spreading lobes. *Petals* 5, dark-coloured when dry (yellow when fresh), orbicular, concave, glabrous. *Staminal tube* turbinate, the mouth 5- or 6-lobed; *anthers* 5 or 6, broadly ovate, the connective slightly apiculate at the apex, the apices bent downwards and not exerted. *Ovary* broad, depressed, pubescent; *stigma* broadly ovoid, the apex sub-2-lobed. *Fruit* (not ripe), obovoid, with depressed sub-bi-lobed apex; the slightly enlarged calyx persistent at the base, minutely cinereous, tomentose.

Perak: King's Collector, Nos. 1874, 2998 and 6494. Wray, No. 2935.

There is some diversity in the size of the leaflets and of the flowers of this species. My collector's gathering No. 2998 above-quoted has narrowly oblong-lanceolate leaflets, and its flowers measure scarcely ·05 in diam.: while the flowers of No. 1874 are quite ·075 in. in diam., and the leaflets of all the other gatherings, except No. 2998, are either elliptic-oblong or ovate. I find that the structure of the flowers is alike whatever their size may be.

9. *AGLAIA CINEREA*, King, n. sp. A shrub 10 to 15 feet high; young branches petioles, rachises, petiolules and inflorescences with numerous minute brown scales. *Leaves* 7 to 12 in. long, unequally pinnate: leaflets 5 to 7, alternate and rather distant; the uppermost pair opposite, thinly coriaceous, oblong- or ovate-lanceolate, often oblique, the apex shortly acuminate, the base cuneate, that of the upper three much narrowed in the lower third; both surfaces cinereous when dry, the lower paler and sparsely covered with rusty stellate scales; main nerves 8 to 13 pairs, oblique, rather straight; length 2·5 to 6 in., breadth 1 to 1·75 in.; petiolules ·35 to ·6 in., that of the odd leaflet sometimes ·8 in. *Panicles* supra-axillary, slender, lax, 5 to 7 in. long, the branches divaricating. *Flowers* small, ·04 in. in diam., globu-

lar, on slender pedicels longer than themselves. *Calyx* with 4 or 5 long spreading unequal blunt lobes nearly as long as the petals, pubescent-lepidote externally. *Petals* 5, concave, rotund, unequal, glabrous. *Staminal tube* shorter than the petals, shortly campanulate with a truncate entire mouth, glabrous: *anthers* 5, shortly ovate, exserted. *Ovary* and *stigma* both depressed. *Fruit* pyriform with a long pseudo-stalk and on a short stout pedicel, minutely pubescent-lepidote, .75 in. long, and .4 in. diam. near the apex.

Malacca: Griffith. Perak: King's Collector, Nos. 2730 and 5235. Scortechini No. 347.

10. *AGLAIA ODORATISSIMA*. Blume Bijdr. 171. A tree 20 to 40 feet high: young branches petioles rachises petiolules and inflorescences with minute brown deciduous scales. *Leaves* 5 to 9 in. long, unequally pinnate; leaflets 5 to 7, oblong-lanceolate, rarely ovate, opposite, thinly coriaceous, shortly acuminate, the base cuneate or rounded; upper surface glabrous, greenish when dry, the lower brown, sparsely (the midrib and nerves rather densely) lepidote; main nerves 6 to 9 (rarely 11) pairs, ascending, curved; length 2 to 5 (occasionally 7) in.; breadth 1 to 2 (occasionally 2.5) in.; petiolules .2 in., that of the terminal one sometimes .3 in., *Panicles* supra-axillary, solitary, 3 to 8 in. long, (occasionally 10 to 12) in., the branches divaricating, densely-flowered. *Flowers* depressed-globular, about .035 in. in diam., on pedicels about as long. *Calyx* cupular, or rather flat, short, with 5 orbicular blunt spreading lobes, pubescent-lepidote outside. *Petals* 5, much longer than the calyx, elliptic or obovate-rotund, unequal, blunt, concave, glabrous, sometimes granular outside. *Staminal tube* shorter than the petals, truncate-campanulate, the mouth open, obscurely 5-lobed: *anthers* broadly ovoid, inserted by a very short filament just below the mouth of the tube, exserted, or inflexed and therefore included. *Ovary* small, depressed, pubescent; *stigma* small, broadly ovoid. *Fruit* ovoid or sub-globose, densely covered with minute brown scales, about .6 in. long, and .4 in. in diam., usually 1-seeded. Miq. Fl. Ind. Bat. Vol. I, pt. 2, p. 544; Ann. Mus. Lugd. Bat. IV. 44. C. DC. Monogr. Phaner. I, 602. *A. Roxburghiana* Hiern, Fl. Br. Ind. I, 555 and C. DC. Monogr. Phaner. I, 604. (not of Miquel.) *Aglaia*? Wall. Cat. 9039? *A. sexipetala*, Griff. Notulæ I, 505.

Malacca; Griffith 1036; Maingay (Kew Dist.), No. 337. Perak; Scortechini, Wray, King's Collector. Singapore: Ridley. Penang; Curtis Nos. 662, 768, 895, 896, 2448. Distrib. Sumatra, Java.

Although resembling *A. Roxburghiana*, Miq. in its calyx and corolla, that has a different staminal tube to which the strictly included more-elliptic anthers are attached near the base, whereas the anthers of

this species are shortly and broadly triangular ovoid and are inserted on the staminal tube close to its mouth. The fruits too are different.

11. *AGLAIA FORBESII*, King, n. sp. A tree 40 to 80 feet high: young branches slender and, like the angled petioles rachises and petiolules, densely and minutely rufous-tomentose. *Leaves* 12 to 15 in. long, equally pinnate; leaflets 8 to 10, membranous, alternate, rather distant, oblong to elliptic, alternate (the upper pair usually opposite) cuspidate, the base slightly cuneate; upper surface olivaceous when dry, glabrous, minutely rugulose, dull; the lower rather pale brown, minutely scurfy: main nerves 10 to 13 pairs, oblique, rather straight, faint on the upper, bold on the lower surface: length 3·5 to 5·2 in., breadth 1·5 to 2·5 in. *Panicles* axillary, solitary, densely stellate-tomentose, 4·5 to 9 in. long, the branches spreading. *Flowers* numerous, .08 in. long, ovoid, on pedicels shorter than themselves. *Calyx* sub-campanulate, densely pubescent outside, glabrous inside, with 5 deep broadly ovate lobes. *Petals* 5, twice as long as the calyx, orbicular or ovate-orbicular, concave, glabrous. *Staminal tube* shorter than the petals, turbinate-globular, the mouth with 5 broad shallow erose teeth, glabrous; *anthers* 5, ovate, included or with their apices exerted. *Ovary* small, depressed, puberulous; *stigma* large, fleshy, broadly ovoid. *Fruit* ellipsoid to ovoid, sometimes slightly gibbous at the base, or narrowly obovoid, not apiculate, pale yellow when ripe, covered with minute scurfy pubescence, 1 to 1·25 in. long, and .7 to .9 in. in diam. when dry; the pedicel short, stout.

Perak: Wray, No. 3265: King's Collector, Nos. 4762 and 10787. Pangkore: Curtis, No. 1631. Distrib. Sumatra, H. O. Forbes, No. 3179.

12. *AGLAIA SQUAMULOSA*, King, n. sp. A tree 30 to 50 feet high: young branches rather stout, the bark striate and densely covered with minute brown scurf-like pubescence. *Leaves* 15 to 30 in., unequally pinnate, petiole rachis and petiolules minutely squamulose-pubescent: leaflets 11 to 15, distant, alternate except the upper pair which are opposite, coriaceous; both surfaces minutely rugulose when dry, the upper glabrous and dull, the lower uniformly covered with shining minute pale-edged scales: main nerves 10 to 12 pairs, oblique, little curved, faint on the upper, bold on the lower surface: length 4 to 10 in., breadth 1·75 to 3·5 in., petiolules .25 to .6 in. *Panicles* axillary, solitary, much branched, spreading, squamulose, angled, many-flowered, 10 to 12 in. long. *Flowers* ovoid, .05 in. long, on pedicels shorter than themselves. *Calyx* cupular, pale-coloured, almost glabrous, divided to the base into 5 shallow broad blunt lobes. *Petals* 5, much longer than the calyx, dark-coloured, rotund, unequal, concave, glabrous. *Staminal tube* shorter than the petals, globose, the mouth

entire: *anthers* 5, ovate, large. *Ovary* rather large, pubescent, extending much beyond the base of the ovoid glabrous stigma. *Fruit* (very young) narrowly elliptic, densely scaly like the under surface of the leaflets.

Perak: King's Collector, Nos. 8805, 11013, 10145.

In its leaves this resembles *A. latifolia* Miq., but the scales on the under surface of this are much larger and more shining. The flowers too of this are much smaller and the calyx and corolla differ.

13. *AGLAIA KUNSTLERI*, King, n. sp. A tree 80 to 40 feet high; young branches rather stout and, like the petioles, rachises, petiolules and inflorescences, covered with minute deciduous, brown pubescence and scales. *Leaves* 18 to 25 in. long, unequally pinnate; leaflets 5 to 13, coriaceous, oblong-oblancoelate to elliptic-oblong, the apices shortly acuminate, the bases usually more or less oblique, rounded or cuneate, the upper leaflets often much narrowed in the lower third: upper surface glabrous, pale green, and minutely rugulose when dry, the lower paler, rugulose, and with sparse, stellate, hairy, minute brown scales: main nerves 10 to 14 pairs, faint on the upper, and only slightly prominent on the lower surface: length 4.5 to 7.5 in., breadth 1.75 to 2.75 in. *Panicles* solitary, axillary, branching, many-flowered, 3 to 9 in. long. *Flowers* .08 in. long, globular-obovoid, on pedicels shorter than themselves. *Calyx* cupular, tapering to the pedicel, with 5 broad blunt spreading shallow lobes, minutely whitish-tomentose with bright rusty superficial stellate-hairy scales. *Petals* 5, much larger than the calyx, broadly elliptic, concave, blunt. *Staminal tube* dark-coloured, pale and scarious towards the base, shorter than the petals, globose, glabrous, 5-lobed; *anthers* 5, broadly ovate, included. *Ovary* rusty-pubescent; *stigma* thick, short, conical. *Fruit* globular, slightly depressed at base and apex, densely covered with minute pale buff-coloured hairs, about .8 in. in diam. when dry, pedicel very short.

Perak: King's Collector, Nos. 5287, 10610.

14. *AGLAIA HUMILIS*, n. sp. King. A shrub or small tree; young branches stout, rusty puberulous, the bark dark-coloured. *Leaves* 18 to 26 in. long, unequally pinnate; leaflets sub-opposite (the upper pair opposite), thinly coriaceous, oblong to elliptic-oblong, rarely ovate, shortly cuspidate, the base rounded or sub-cuneate; both surfaces minutely punctulate when dry, the upper glabrous except the puberulous midrib; the lower glabrous, the midrib and nerves stellate-pubescent; main nerves 11 to 20 pairs, spreading, prominent on the lower, depressed on the upper surface when dry; length 4 to 9 in., breadth 1.75 to 3.5 in.; petiolules .25 to .6 in. *Panicles* supra-axillary, solitary, 3 to 6 in. long, with few-flowered very short branches. *Flowers* globular, .06 in. in

diam. *Calyx* campanulate, pubescent-lepidote outside, the mouth with 5 large rounded teeth. *Petals* 5, longer than the calyx, elliptic, glabrous. *Staminal tube* shorter than the petals, obovoid-globose, glabrous, the mouth with 5 shallow broad blunt teeth; anthers 5, ovate-ellipsoid, included, short. *Ovary* rather broad, pubescent, with a large glabrous conical 2-lobed stigma. *Fruit* (young) globular-obovoid, 2-celled; the pericarp fleshy, cinereous-pubescent externally.

Perak: King's Collector, No. 8619; Wray, No. 3763.

15. *AGLAIA ARGENTEA*, Blume Bijdr. 170. A slender tree 10 to 15 or 20 feet high; young shoots, petioles, rachises, petiolules, inflorescences and under surfaces of the leaves densely covered with a layer of minute tomentum with many stellate hairs and flat shining white or pale-brown scales intermixed and on the surface. *Leaves* 24 to 30 in. long, unequally pinnate; leaflets 7 to 11, alternate, the odd one and the upper pairs often much the largest, thinly coriaceous, oblong-lanceolate to ovate-lanceolate or elliptic, the odd leaflet and often also the upper pair often much cuneate at the base, the lower pairs often rounded, occasionally minutely cordate and sub-sessile, the apices of all more or less acuminate: upper surface glabrous, the lower shining silvery to pale brown; main nerves 12 to 24 pairs, inconspicuous on the upper bold and prominent on the lower surface; length of the lower leaflets 5 to 9 in., of the terminal one 12 to 15 in., breadth 2 to 5 in., petiolules 2 in. *Panicles* supra-axillary, pedunculate, spreading, very dense, 3 to 5 in. long. *Flowers* crowded, numerous, sessile, sub-globular, .08 in. in diam., *Calyx* half as long as the corolla, deeply divided into 5 broad rounded imbricate concave lobes, furfuraceous-lepidote externally, glabrous internally. *Petals* 5, concave, orbicular, glabrous. *Staminal tube* globular, shorter than the petals, the mouth sub-entire; anthers 5, ovate, included. *Ovary* depressed; stigma sub-cylindric, truncate, glabrous. *Fruit* ovoid or obovoid, minutely rusty-pubescent and lepidote, .8 to 1.25 in. long, Miq. Flor. Ind. Bat. Vol. 1, Pt. 2, 548; Ann. Mus. Lugd. Bat. IV, 54; Kurz For. Flor. Burma I, 219; C. DC. Monogr. Phaner. I, 618. *A. hypoleuca*, Miq. Ind. Bat. Suppl. 507. *A. speciosa*, Teyssm. and Binn. Cat. Hort. Bogor. 211 (not of Blume). *Milnea argentea*, Reinw. in Cat. Hort. Bogor. 71.

Perak: King's Collector, No. 3135. Nicobar Islands, Kurz.—Distrib. Burma, Sumatra, Java, New Guinea.

This is a widely distributed and variable species of which Miquel (Ann. Mus. Lugd. Bat. IV, 55) enumerates no less than seven varieties, most of which he had himself previously treated as species. In young shoots the leaflets are often few but very large.

Var. *aristata*, Miq. Ann. Mus. Lugd. Bat. IV, 55. *Flowers* ovoid;

petals elliptic, staminal tube ovoid; leaflets 15 to 25, oblong, opposite, sub-sessile, the bases rounded, 3 to 6 in. long, the terminal one not longer than the pairs but with a narrow base: under-surfaces from pale to cinnamonaceous, not shining. *A. eximia*, Miq. Fl. Ind. Bat. Suppl. 506. *A. ancolana* Miq. l. c. 506.

Perak: King's Collector, Nos. 5767 and 10007. Distrib. Sumatra,

Var *Curtisii*, King. Flowers ovoid, .15 in. long: petals elliptic; staminal tube globular, the apical aperture very small and almost entire. Leaflets 15 to 19, oblong, shortly acuminate and with rounded bases, the terminal one not larger than the others. Fruit narrowly pyriform, densely lepidote.

Penang; Curtis, No. 2287. Perak: King's Collector, No. 8239.

16. *AGLAIA LANUGINOSA*, King, n. sp. A tree 50 to 70 feet high; young branches very stout (1 in. in diam.), rugulose and rusty-tomentose between the large triangular leaf-cicatrices. Leaves 2 to 4 feet long, unequally pinnate everywhere, except on the upper surfaces of the leaflets, densely covered with soft rusty stellate tomentum; leaflets 9 to 13, the pairs opposite, thinly coriaceous, oblong, cuspidate, the base rounded and often minutely cordate; upper surface glabrous; main nerves 28 to 36 pairs, sub-horizontal, slightly prominent on the lower, faintly depressed on the upper surface, length 5 to 15 in., breadth 2 to 3.5 in., petiolules .25 to .4 in. Panicles axillary, from 9 to 12 in. long, stout; branches few, ascending and bearing short lateral spikes. Flowers sessile, densely crowded, depressed-globular, about .1 in. in diam. Calyx completely enveloping the petals, with 5 deep narrow lobes covered outside with soft stellate wool, inside glabrous. Petals 5, elliptic, blunt, glabrous, concave, slightly shorter than the calyx. Staminal tube shorter than the petals, its mouth wide and deeply 5-lobed, glabrous; anthers opposite its lobes, large, included. Ovary small; stigma cylindric. Fruit unknown.

Perak: Scortechini, No. 1682; King's Collector, Nos. 7381, 7714.

This species resembles the Bornean *A. grandis*, Miq. in its leaves, but has different flowers. Fruit of both species is unknown.

17. *AGLAIA CURTISII*, King, n. sp. A tree 60 to 80 feet high; young branches stout, rusty puberulous. Leaves 18 to 30 in. long, unequally pinnate; leaflets coriaceous, 11 to 15, sub-opposite, oblong to elliptic, shortly acuminate; the bases of the lower rounded, of the upper cuneate, upper surface glabrous and when dry minutely pustulate, the midrib puberulous; under surface covered with dense minute rusty tomentum with numerous stellate hairs on the surface; main nerves 16 to 24, spreading, prominent beneath; length 6 to 9 in., breadth 2 to 4 in., petiolules .2 to .35 in. Panicles slightly supra-axillary, solitary, 6

to 8 in. long, with few sub-erect branches; the branchlets short, densely flowered, all scurfy puberulous. *Flowers* globose, sessile, more than .1 in. in diam. *Calyx* of 4 or 5 thick densely tomentose sub-rotund sepals. *Petals* 5, glabrous. *Staminal tube* short, sub-globular, with a wide mouth; *anthers* 5, short, attached close to the mouth of the tube, their apices included. *Fruit* globular-obovoid, minutely rusty puberulous, 1.5 in. long, and 1.25 in. in diam.

Pangkore: Curtis, No. 1627. Perak; King's Collector, No. 7786.

A species allied to *A. pachyphylla*, Miq., and not easy by description alone to be distinguished from that species. An examination of Miquel's type specimen of *A. pachyphylla* kindly lent to me by the authorities of the Leiden Herbarium shows that the leaves of that are distinctly falcate, while those of this are not: moreover the leaves of *A. pachyphylla* taper much more to the apex, and the panicles are more robust, than is the case in this species. The tomentum on the under surface of the leaves differs in character in the two species; and in the leaves of *A. pachyphylla* the midribs of the leaves are raised and ridge-like on the upper surface, while these of this species are depressed. The fruit of *A. pachyphylla* is unknown.

18. *AGLAIA PALEMBANICA*, Miq. Flor. Ind. Bat., Suppl. 507. A tree 10 to 25 feet high; young shoots, petioles and rachises, petiolules and inflorescence densely rusty stellate-tomentose. *Leaves* 4 to 9 in. long, unequally pinnate; *leaflets* 5 to 9, sub-opposite, membranous, oblong-lanceolate to ovate, opposite or sub-opposite, shortly acuminate, the base cuneate, the terminal and upper pairs of leaflets with bases much narrowed; upper surface sometimes decidedly lepidote, ultimately glabrous, except sometimes the pubescent lower half of the midrib; lower surface more or less closely stellate-pubescent, especially on the midrib and 6 to 11 pairs of spreading main nerves; length 1.5 to 5 in., breadth .65 to 1.75 in., petiolules .15 in. *Panicles* solitary, axillary, 1.5 to 4 in. long, slender, their branches short and divaricating, bearing the flowers in dense short spikes. *Flowers* depressed-globular, about .025 in. in diam. *Calyx* with 5 long narrow acute or sub-acute spreading unequal lobes, some of them occasionally longer than the petals, boldly stellate-tomentose outside, glabrous inside. *Petals* 5, obovate-elliptic, concave, glabrous. *Staminal tube* shorter than the petals, glabrous, its mouth truncate entire; *anthers* 5, ovate, curved, half-exserted. *Ovary* large, pubescent, stigma 3-angled. *Fruit* ellipsoid (narrowly so when young), deciduously stellate-tomentose, .75 in. long, and .6 in. in diam. Miq. Ann. Mus. Lugd. Bat. IV., 52; Hiern in Hook. fl. Fl. Br. Ind. I, 557; C. DC. Monogr. Phaner. I, 619. *Aglaia Sipannas*, Miq. Fl. Ind. Bat. Suppl. 508. *A. tomentosa*, Teyssm. and Bian. in Nat. Tijdschr. Ned.

Ind. Vol. 27. p. 48. *A. rufa*, Miq. in Ann. Mus. Lugd. Bat. IV, 649. C. DC. Monogr. Phaner. I, 618.

Malacca: Griffith, No. 1043. Maingay (Kew Distrib.), No. 333. Penang: Curtis, No. 2003; King's Collector, No. 1790. Perak: Scortechini, Wray, King's Collector. Kedah: Curtis, No. 2520. DISTRIBUTION: Sumatra, Bangka, Borneo.

This differs from its nearest ally *A. Griffithii* in its large, irregularly lobed, very tomentose calyx, and in its smaller fruit and leaves. I have examined authentic specimens of *A. Sipannas*, Miq. and of *A. rufa*, Miq., and I cannot see how they are to be separated from *A. palembanica*, Miq. A specimen in the Leiden Herbarium, collected by Korthals in Sumatra, and named in Miquel's handwriting *A. elliptica*, Blume, var. *Sumatra*, ought in my opinion to be referred to this species. The plant named by Teysmann and Binnindyk *A. tomentosa*, and of which Curtis's specimen from Kedah, No. 2520, is an example, has longer leaflets than typical *A. palembanica*, with more nerves, and more tomentose beneath; but I think its reduction to this is justifiable. This plant has a wider distribution than is usual with species of this family, and slight local differences are thus naturally to be expected.

19. *AGLAIA CORDATA*, Hiern in Hook. fil. Fl. Br. Ind. I, 557 (excl. var. 2). A tree 20 to 30 feet high, young shoots, petioles, rachises, petiolules and inflorescence more or less densely clothed with rusty or tawny stellate-tomentum. Leaves 7 to 15 in. long, unequally pinnate; leaflets 7 to 9, the pairs opposite, rarely sub-opposite, membranous, oblong-oblancoelate, rarely ovate or elliptic, all with shortly acuminate apices, the odd one the largest and much attenuate towards the base, the paired leaflets cuneate, minutely cordate at the very base; upper surface glabrous, the midrib slightly pubescent; the lower stellate-pubescent, sometimes densely so, the midrib always, and the nerves usually, tomentose; main nerves 10 to 14 pairs, oblique, slightly depressed on the upper surface when dry and prominent on the lower: length 4 to 6 in., breadth 1.75 to 2.25 in., petiolules less than .1 in. or absent; the terminal leaflet larger and with a petiolule .2 to .4 in. long. Panicles axillary, solitary, 3 to 6 in. long, the branches spreading, the ultimate branchlets shorter, spike-like, and densely crowded with flowers. Flowers about .35 in. in diam., sub-sessile, otherwise as in those of *A. palembanica*. Fruit globular or ovoid, densely covered with deciduous rusty stellate tomentum, .5 to .65 in. in diam. C. DC. in Monogr. Phaner. I, 618 (excl. var. b. *calyce glabro*).

Malacca: Maingay (Kew Distrib.), Nos. 334, 335/2. Singapore: Ridley, No. 333. Perak: Scortechini; Wray, No. 2962; King's Collector, Nos. 2836, 3646, 5071, 6360.

Under his species *A. cordata*, Mr. Hiern has in my opinion included two plants. The species *A. cordata*, as here limited, includes only Hiern's form with hirsute calyx, and is really little more than a large-leaved variety of *A. palembanica*. Mr. Hiern's form with glabrous calyx is, in my opinion, a distinct species, the calyx differing not only in being glabrous, but in being much smaller, and of quite a different shape. I have described it as a species under the name *A. Hiernii*.

20. *AGLAIA HIERNII*, King, n. sp. A tree 40 to 80 feet high; young branches, petioles, rachises, petiolules and inflorescences, densely clothed with rather soft rusty stellate tomentum. *Leaves* 14 to 18 in. long, unequally pinnate; leaflets 7 to 9, the pairs opposite, thickly membranous, oblong or oblong-lanceolate; the terminal one oblong-oblancoate, longer than the others and two or three times as long as the petiolule; the apices of all shortly and sharply acuminate, the bases cuneate, especially of the uppermost ones; upper surface glabrescent with a few scattered stellate-hairs, the midrib and nerves densely stellate-pubescent; under-surface uniformly covered with pale-brown-centred scales and a superficial layer of rufous stellate tomentum; main nerves 13 to 22 pairs, sub-horizontal, depressed on the upper and bold on the lower surface when dry; length 4 to 6 in. (the odd one an inch longer); breadth 1.75 to 2.25 in., petiolules of the pairs .15 in. *Panicles* slightly supra-axillary, solitary, 8 to 12 in. long, the branches divaricating, the ultimate branchlets bearing densely-flowered spikes. *Flowers* .4 in. long, sessile, globular. *Calyx* cupular, quite glabrous, with 4 or 5 deep broad rounded imbricate lobes. *Petals* 5, rotund or ovate-rotund, unequal, much longer than the calyx, the outer 3 the largest, all concave and glabrous. *Staminal tube* shorter than the petals, cup-shaped, the mouth wide; the 5 ovate *anthers* inserted by very short filaments on the edge of the tube, but inflexed so as to be included. *Ovary* small, pubescent; *stigma* depressed-spheroidal, pubescent. *Fruit* unknown.

Malacca: Maingay. Perak: King's Collector, Nos. 5976, 6706, 10877.

This is allied to *A. cordata*, Hiern, but differs from it in having leaflets with more numerous and more horizontal main nerves, more densely tomentose and lepidote beneath. The calyx of this, moreover, is conspicuously different, being smaller, having broad lobes much shorter than the petals, and quite glabrous, while the calyx of *A. cordata*, as limited here, has a large calyx densely stellate-tomentose externally, and with acute lobes often longer than the petals. This is a large tree, often attaining a height of 80 feet, while *A. cordata* is a small tree from 20 to 30 feet high.

21. *AGLAIA GRIFFITHII*, Kurz in Journ. As. Soc. Bengal, for 1875, p. 146. A tree 30 to 50 feet high; young branches petioles, rachises, petiolules and inflorescences densely clothed with minute rusty stellate pubescence. Leaves 12 to 18 in. long, unequally pinnate; leaflets 13 to 19, opposite or sub-opposite, narrowly elliptic or oblong-lanceolate, often slightly oblanceolate, shortly acuminate, the base rounded or sub-cuneate: upper surface glabrous except the rusty tomentose midrib, the nerves inconspicuous; lower surface sparsely stellate-pubescent, the midrib and 10 to 12 pairs of bold curved spreading nerves tomentose; length 2·5 to 5 or even 6 in., breadth 1 to 1·4 in., petiolules about ·15 in. Panicles solitary, axillary, spreading, many-branched, many-flowered. Flowers about ·025 in. in diam, depressed-globular, broader than long. Calyx cupular with 5 deep broad lobes, pubescent outside. Petals 5, twice as long as the calyx, concave, glabrous. Staminal tube shorter than the petals, glabrous; anthers 5, ovate, partly exserted. Ovary pubescent; stigma depressed-hemispheric. Fruit pyriform, densely covered with sub-deciduous rusty scurfy stellate tomentum, 1·75 in long, and 1·25 in. in diam. Kurz For. Flora Burma I, 219. *A. minutiflora* Bedd. var. *Griffithii*, Hiern in Hook. fil. Fl. Br. Ind. I, 557; C. DC. in Phaner. Monogr. 1, 616.

Malacca: Griffith, Nos. 1039 and 1040: Maingay, No. 334-2 (No. 334 is *A. cordata*, Hiern). Perak Scortechini, Wray, King's Collector, Nos. 4231, 6282, 6341, 6346, 10285, 10925, 10957.

The flowers of this are less than half the size of those of *A. minutiflora* Bedd.—a plant of Western Peninsular India, of which Mr. Hiern and M. C. De Candolle make this a variety. On dissecting male flowers of an authentic specimen of Beddome's plant I find, however, that not only are the flowers larger, but they are of a different shape, being globular-obovoid, while those of this plant are depressed-globular and broader than long. The calyx of this, moreover, is about half as long as the petals, while the calyx of Beddome's plant is not more than a third or a fourth of the length of its petals. Moreover, the leaflets of *A. minutiflora* Bedd., are less numerous than in this plant, and the tomentum on their lower surface is much more dense. The fruit hitherto described as belonging to this plant, is that issued from Kew as No. 334 of Maingay's Herbarium. That fruit, however, does not belong to this species, but to *A. cordata*, Maing. It is globular and, in size as well as in shape, greatly resembles that of *A. minutiflora*. The true fruit of this (now described for the first time) is pyriform and much larger than that of *A. minutiflora*. On account of these differences, I therefore follow Kurz in regarding this as a distinct species from the latter.

22. *AGLAIA MEMBRANIFOLIA*, King, n. sp. A tree 20 to 60 feet high.

Leaves 2 to 3 feet long, the petioles, rachises and petiolules covered with minute harsh tomentum, unequally pinnate; leaflets from 7 to 11, thinly membranous, elliptic-oblong, acuminate, the base cuneate; upper surface glabrous, pale greenish when dry, the lower surface darker and sometimes with a tinge of purple, very sparsely and minutely stellate-pubescent, the midrib boldly so; main nerves 20 to 30 pairs, faint on the upper, bold on the lower surface; length 9 to 15 in., breadth 2·75 to 5·5 in., petiolules only about ·1 in. *Panicles* everywhere stellately rusty-pubescent, slightly supra-axillary, with numerous, many-flowered, spreading branches. *Flowers* about ·035 in. in diam., depressed-globular, almost sessile, often with a few bracteoles at the base. *Calyx* rotate, with 5 deep broad rounded membranous pubescent lobes. *Petals* 5, broadly ovate to rotund, longer than the calyx, glabrous, concave. *Staminal tube* shorter than the petals, cupular, sub-entire, glabrous; *anthers* 5, ovate, curved, exserted. *Ovary* small, much depressed; *stigma* depressed-spheroidal, vertically grooved. *Fruit* ovoid or ovoid-globose, tapering at the base into a short pseudo-stalk, densely covered with minute scaly tawny tomentum, 1 in. long, and ·75 in. in diam.

Perak: King's Collector, Nos. 5901 and 7104. DISTRIBUTION: Sumatra; Forbes, No. 1679.

This resembles *A. tenuicaulis*, Hiern; but it has smaller flowers, different calyx and staminal tube and larger fruit. The texture of the leaflets is also thinner and the stellate hairs on their under surface less numerous.

23. *AGLAIA TENUICAULIS*, Hiern in Hook. fl. Fl. Br. Ind. I, 556. A shrub or small tree 10 or 12 feet high with a slender stem 2 to 3 in. in diam. *Leaves* 3 feet or more in length, unequally pinnate; the long petiole, rachises, petiolules and young branches densely stellate rusty-tomentose; leaflets membranous, oblong to elliptic, minutely cuspidate to shortly acuminate; the base cuneate, rarely rounded; upper surface glabrous, the lower sparsely minutely stellately rufous-pubescent; main nerves 15 to 20 pairs, spreading, obsolete on the upper prominent on the lower surface; length 6 to 12 in., breadth 2·5 to 4·5 in.; petiolules ·3 to ·35 in., stout. *Panicles* slightly supra-axillary, everywhere densely rufous-pubescent like the petioles, about 12 in. long, with spreading densely-flowered branches, those bearing fruit only a few inches long. *Flowers* ·05 in. long, globular, on pedicels longer than themselves. *Calyx* cupular, stellate-pubescent outside, glabrous inside, with 5 deep acute spreading teeth. *Petals* 5, much longer than the calyx, ovate or sub-obovate, concave, elliptic, glabrous. *Staminal tube* shorter than the petals, globular, inflated about the middle of the sub-entire mouth, glabrous except at the base inside; *anthers* 5, short, ovate, included. *Ovary*

small, stellate-hairy. *Stigma* elliptic, obtuse. *Fruit* obovoid, rugulose, densely covered with minute rusty stellate-tomentum, about $\frac{1}{4}$ in. long, C. DC. in Monogr. Phaner. J, 615.

Penang: Maingay (Kew Distrib.), No. 3252. Curtis, No. 747. Selangor; Ridley. Perak; Wray, King's Collector, Scortechini. Singapore; Lobb. DISTRIB. Sumatra.

24. *AGLAIA TRICHOSTEMON*, C. DC. Monogr. Phaner I, 608. A tree 30 to 60 feet high; young shoots, petioles and rachises of leaves and inflorescences decidedly rusty stellate-tomentose, scabroid beneath the tomentum. *Leaves* 18 to 27 in. long, unequally pinnate; leaflets 9 to 13, alternate or opposite, sub-coriaceous, oblong to elliptic, shortly acuminate, the base slightly cuneate or rounded; upper surface glabrous, the lower sparsely and minutely stellately pubescent; main nerves 12 to 16 pairs, slightly depressed on the upper surface when dry, bold on the lower; length 4 to 8 in.; breadth 2 to 2.75 in.; petiolules $\frac{1}{25}$ to $\frac{1}{4}$ in. *Panicles* supra-axillary, solitary, nearly as long as the leaves, with few divaricating lax branches, densely and minutely rusty stellulate-pubescent and scaly. *Flowers* obovoid, globose, $\frac{1}{8}$ in. long, on pubescent pedicels shorter than themselves. *Calyx* shallow, cupular, deeply divided into 5 rotund, blunt, spreading lobes, pubescent externally. *Petals* 5, slightly unequal, ovate-rotund, concave, glabrous, much longer than the calyx. *Staminal tube* shorter than the petals, thin, puberulous, obovate, the mouth with 5 broad emarginate shallow teeth; *anthers* 5, broadly ovate, small, inserted near the edge of the tube, included. *Disc* rather large, inferior to the ovary, pubescent. *Ovary* small, cylindric, 4-angled, glabrous. *Fruit* globular to ovoid, shortly pedicelled, densely covered with minute rusty stellate tomentum, $\frac{1}{4}$ to $\frac{1}{6}$ in. long. *Cupania rufescens*, Wall. Cat. 8067 B (exclude A). *Aglaiia edulis*, Hiern in Hook. fil. Fl. Br. Ind. I, 1556. *Aglaiia cupanioides*, King MSS.

Penang; Wallich. Perak; Scortechini, King's Collector, Nos. 5597, 5901. Pahang; Ridley, No. 5885. Singapore, Anderson, No. 29; Ridley, No. 5833. Malacca; Derry, Nos. 1076, 1186. Distribution Borneo, Beccari, No. 3981.

Although first collected so long ago as Wallich's time, fruit of this very distinct species is now described for the first time. It resembles *A. tenuicaulis* and *A. membranifolia* to some extent in its leaves, but is a much larger tree than either, and its leaflets have a thicker texture. Its fruits are much smaller than those of *A. membranifolia*; and, although of about the same size as those of *A. tenuicaulis*, they are covered with much shorter tomentum. Specimens of this were distributed from the Calcutta Herbarium under the MSS. name *Aglaiia cupanioides*, King MSS.

25. *AGLAIA MACROSTIGMA*, King, n. sp. A tree 40 to 60 feet high; young branches very stout, lenticellate, puberulous. Leaves 2·5 to 4 feet long, unequally pinnate, the petioles very long, 3 in. thick, and, like the rachises petiolules and inflorescence, covered with minute brown scales; leaflets 15 to 17, the pairs opposite or nearly so, membranous, elliptic to elliptic-oblong, slightly oblique, shortly and sharply acuminate, the base rounded; upper surface everywhere glabrous, the lower glabrous, the midrib and nerves rugulose and minutely scaly: main nerves 12 to 20 pairs, depressed on the upper surface, very prominent on the lower; length 5 to 10 in., breadth 2 to 4 in., petiolules 5 to 7 in. Panicles axillary, solitary, about 12 in. long (including the long peduncle), the branches rather short, many-flowered. Flowers broadly obovoid, about 0·8 in. long, on short stout rusty-tomentose pedicels. Calyx half as long as the corolla, cup-shaped, the mouth with 4 unequal broad valvate teeth, rusty-stellate-tomentose externally. Petals 5, glabrous, imbricate, the two external longer and orbicular, the 3 inner smaller and elliptic. Staminal tube shorter than the petals, cupular, the mouth wide and with 8 to 10 lanceolate teeth; anthers 7 or 8, large, elliptic, much exerted. Ovary depressed, 3 angled, 3-celled, yellowish-pubescent, crowned by a glabrous erect fleshy deeply-furrowed 3-angled stigma. Fruit elliptic-obovoid, narrowed to a short pseudo-stalk, covered with minute pale scales, 1·5 in. long, and 1 in. in diam.

Perak: King's Collector, Nos 6531, 6919, 7559.

Like *A. heteroclita*, King, this species has more than 5 stamens, and it has a larger stigma than is usually found in *Aglais*. Its inflorescence is quite that of *Aglais*, as also is its fruit.

26. *AGLAIA HETEROCLITA*, King, n. sp. A tree 30 to 40 feet high, glabrous except the inflorescence and under surfaces of the leaves. Leaves 18 to 30 in. long, equally or unequally pinnate: leaflets thinly coriaceous, 8 or 9 to 10 or 11, distant, alternate, oblong to elliptic-oblong, oblique, more or less acuminate, the base cuneate and oblique: both surfaces dull and pale when dry (especially the lower), the upper glabrous, the lower with sparse minute rusty stellate scales; main nerves 12 to 16 pairs, spreading, faint on the upper, and only slightly conspicuous on the lower surface; length 4 to 7 in., breadth 1·5 to 2·75 in.; petiolules 35 to 75 in., slender. Panicles axillary or terminal, 2·5 to 6 in. long, stout, the branches not divaricating, the ultimate branchlets minutely bracteolate, densely flowered. Flowers 125 in. long, sub-globular, on thick pedicels shorter than themselves and with a spongy epidermis. Calyx fleshy, corrugated, conspicuously pellucid-dotted, deeply divided into 5 broad rounded imbricated concave lobes. Petals 5, somewhat longer than the calyx and thinner, not dotted, ellip-

tic, blunt, concave especially towards the apex. *Staminal tube* shorter than the petals and darker in colour, globular-cylindric, the mouth obscurely lobed. *Anthers* 7 or 8, elliptic, included. *Ovary* pyramidal, fleshy, grooved, pubescent, 2-celled, crowned by the glabrous, broadly and shortly cylindric, grooved, indistinctly 2-lobed stigma. *Ovules* 2 in each cell, superposed. *Fruit* obovoid or pyriform, shortly apiculate, minutely scaly-tomentose, about 1 in. long including the pseudo-stalk, and .8 in. in diam., apparently indehiscent, 1- or 2-seeded.

Perak; King's Collector, No. 10896, Wray (at elevation of 3400 ft.), Nos. 1135, 3994. *DISTRIB* Sumatra, Forbes, Nos. 1558 and 1696.

This differs from typical *Aglais* in having 7 or 8 stamens, and its stigma is that of *Amoora* rather than of *Aglais*. The inflorescence resembles that of *Aglais argentea*, Bl.

27. *AGLAIA ANDAMANICA*, Hiern in Hook. fil. Fl. Br. Ind. I, 218. A tree 30 to 40 feet high; young branches, petioles, midribs, inflorescence and calyx covered with pale-brownish deciduous scales. *Leaves* 12 to 15 in. long, unequally pinnate; leaflets 5 to 7, alternate, membranous, ovate-elliptic to elliptic, shortly and obtusely acuminate, the base rounded or sub-cuneate, slightly oblique; main nerves 13 to 15 pairs, faint; upper surface glabrous, shining; the lower dull, sparsely scaly; main nerves 13 to 16 pairs, oblique, slightly prominent below; length 4 to 6 in., breadth 2 to 3 in., petiolule .25 to .35 in. *Panicles* crowded towards the ends of the branches, axillary, solitary, 2 to 3 in. long, many-flowered. *Flowers* broadly ovoid, truncate, .15 in. long, on pedicels shorter than themselves. *Calyx* cupular, puberulous and scaly outside, the mouth with 5 pointed minute erect teeth. *Petals* 5, larger than the calyx, elliptic, slightly obovate, the apex blunt and incurved, puberulous externally, the edges membranous and glabrous. *Staminal tube* ovoid-globose, the apex sub-truncate, with 4 obscure broad teeth; *anthers* 8 or 9, narrowly elliptic, sessile, inserted at the base of the tube, included. *Ovary* small, depressed, 3-angled, densely tawny-tomentose; *stigma* sub-capitate, glabrous, fleshy, 2-3-angled. *Fruit* narrowly ellipsoid, lepidote, 1.5 in. long. Kurz For. Flora Burma. I, 218. O. DC. Monogr. Phaner. I, 606. *Amoora dysosyloides*, Kurz Journ. As. Soc. Bengal II, 1875, p. 200; I, 222. O. DC I c. I, 589.

The Andaman and Nicobar Islands; Kurz, King's Collectors. *DISTRIB*. Great Coco Island, Prain. Burma, Brandis.

Kurz described his *Amoora dysosyloides* on scanty specimens collected by Sir Dietrich Brandis in Burma. I have carefully dissected flowers from these and I find they are those of an *Aglais*, and belong to *A. andamanica*, Hiern.

28. *AGLAIA MAINGAYI*, King, n. sp. A shrub? young branches, thin,

with pale bark and minute brown scales. *Leaves* 4 to 6 in. long; *leaflets* 4 or 5, alternate or opposite, membranous, oblong-elliptic, shortly and bluntly acuminate, the base cuneate, both surfaces glabrous; main nerves 6 to 9 pairs, ascending, faint; length 2·5 to 3·5 in.; breadth 1·15 to 1·5 in., petiolule ·25 in. *Panicles* one or two from an axil, shorter than the leaves, slender, much branched, scaly. *Flowers* on pedicels as long as themselves, depressed-globular, ·15 in. in diam. *Calyx* widely cupular, pubescent and scaly outside, with 4 or 5 broad shallow erect unequal teeth. *Petals* 4 or 5, larger than the calyx, obovate, the upper half concave, glabrous or puberulous, attached by their bases to the staminal tube. *Staminal tube* depressed-globose, the mouth wide and obscurely toothed, puberulous below the anthers inside; *anthers* 10, half as long as the tube, ovate, included. *Ovary* minute, depressed, pubescent, 3-celled, 3-ovuled; *stigma* short, cylindric, glabrous. *Fruit* (young) broadly obovoid, deeply 3-grooved, puberulous, 3-celled, with a single seed in each cell. *Aglaia Maingayi*, Hiern in Hook. fil. Fl. Br. Ind. I, 562. C. DC. Monogr. Phaner. I, 588.

Malacca: Maingay (Kew Distrib.), No. 342 (Herb. prop. No. 1910). Perak: King's Collector, No. 3325, Scortechini.

Doubtful Species.

A tree has been collected in Perak both by Mr. Wray and Mr. Kunstler (Collector of the Calcutta Botanic Garden), which I believe to be *Aglaia Korthalsii*, Miq. The Perak specimens are in fruit only; and it is only by comparison with Miquel's type specimen of *A. Korthalsii* in the Leiden Herbarium (which is in flower only), that I have made the identification. The species closely resembles *A. macrostigma*, King, but has shorter leaves with more slender rachises and petiolules: the fruit is also larger and more obovoid. I have distributed the Perak plant as doubtfully *A. Korthalsii*, but not having flowers, I do not describe it here.

8. *LANSIUM*, Rumph.

Trees with unequally pinnate leaves; the leaflets quite entire, alternate or opposite, shortly petiolulate. *Flowers* polygamo-dioecious, 5-merous, axillary, the male usually paniculate, the female spicate-racemose. *Sepals* rounded, imbricated. *Petals* rounded, connivent, concave, imbricated. *Staminal tube* globose, the mouth entire or crenulated; *anthers* 10, obtuse, usually in two rows, the shorter ones included, the longer partly exserted, sometimes apiculate. *Disk* obsolete. *Ovary* globose, 3-5-celled; cells 1-2-ovuled; *style* very short, thick; *stigma* truncate, 3-5-lobed. *Fruit* baccate, edible, 1-5-celled, cells

1-2-seeded; seeds oblong, invested in a pulpy aril, exalbuminous.—
DISTRIB. Four species, all Indo-Malayan.

Leaflets 5 to 10 in. long; main nerves about

10 pairs 1. *L. domesticum*.

Leaflets 2 to 3 in. long; main nerves very

numerous 2. *L. cinereum*.

Doubtful species 3. *L. pedunculatum*.

1. *LANSIUM DOMESTICUM*, Jack in Trans. Linn. Soc. XIV, 115, t. IV.
f. 1. A tree 30 to 50 feet high; young branches with pale glabrous lenticellate bark. Leaves 12 to 18 in. long, leaflets 5 to 7, alternate, coriaceous, oblong-elliptic, sometimes slightly obovate, abruptly shortly and obtusely acuminate, narrowed and slightly unequal at the base; both surfaces shining, reticulate, glabrous or slightly puberulous toward the base; main nerves about 10 pairs, ascending, curved, depressed on the upper, prominent on the lower surface when dry; length 5 to 10 in., breadth 2.75 to 4 in., petiolules .5 in.; the terminal 1 in., jointed. Hermaphrodite spikes from the trunk and larger branches, solitary or in fascicles, pubescent, much shorter than the leaves. Flowers sessile or on very short pubescent pedicels, solitary, minutely bracteolate at the base. Calyx fleshy, puberulous, with 5 shallow rounded teeth. Petals longer than the calyx, sub-rotund, glabrous. Staminal tube sub-globose, the mouth sub-entire, truncate, shorter than the petals, the stamens in a single row. Ovary sub-globular, tomentose, 5-celled; style short, thick, 10-furrowed; stigma large, discoid. Berry oblong-ovate to obovoid, sub-tomentose, 1 to 1.5 in. long; seeds usually about 2, embedded in much transparent pulp. Correa de Serra in Ann. Mus. X, 157, t. 7, fig. 1; Blume Bijdr. 165; A. Juss Mem. Mel. 81; Miq Fl Ind Bat. Vol I, Pt. 2, 545; Hiern in Hook. fil. Fl. Br. Ind. I, 558; C. De Cand. Monogr. Phaner. I, 598

Malacca: Griffith, Maingay (Kew Distrib.), No. 338 Perak: Wray, King's Collector, common. Cultivated in all the Provinces, except the Andamans and Nicobars, on account of its edible fruit. DISTRIB. The Malayan Archipelago.

There are several varieties of this which have been by some authors regarded as species, e.g., *L. aqueum*, Jack, *L. humile*, Haack.

2. *LANSIUM CINereum*, Hiern in Hook. fil. Fl. Br. Ind. I, 558. A tree; young branches tawny-pubescent at first, afterwards cinereous. Leaves 3 to 5 in. long, unequally pinnate; leaflets 3 to 5, opposite, sub-coriaceous, elliptic-oblong, obtusely cuspidate, the base acute; both surfaces quite glabrous, pale when dry; main nerves very numerous, obscure; length 2 to 3 in., breadth .8 to 1.5 in., petiolules .1 to .25 in. Spikes nearly as long as the leaves, glabrous. Flowers hermaphrodite.

Calyx cupular, puberulous, with 5 obscure rounded teeth. *Petals* obovate, glabrous. *Anthers* oblong, macronate. *Ovary* globose, pubescent, 5-celled, longer than the glabrous style. *Fruit* unknown. C. DC. Monogr. Phaner. I, 598.

Malacca: Maingay (Kew Distrib.), No. 339.

Known only by Maingay's scanty specimens.

3. *LANSIUM PEDICELLATUM*, Hiern in Hook fil. Fl. Br. Ind. I, 558. A tree; young branches pale brown, scaly. *Leaves* 9 to 12 in. long, unequally pinnate; leaflets 3 to 5, alternate or sub-opposite, thinly coriaceous, elliptic, shortly and sharply acuminate; the base oblique, obtuse or cuneate; both surfaces glabrous; main nerves 8 to 10 pairs, ascending, spreading, slightly prominent beneath; length 3 to 6 in., breadth 1.5 to 2.5 in., petiolules .15 to .25 in. *Male flowers and inflorescence* unknown. *Racemes of female flowers* 1 to 2 in. long, axillary, sometimes with a branch at the base; flowers on pedicels .1 to .15 in. long. *Ovary* minutely tomentose, 4-celled; *stigma* sessile. *Young fruit* sub-globose, fleshy, shortly tomentose.

Malacca: Maingay (Kew Distrib.), No. 856.

The above description is drawn up from the only two specimens which I have seen, and from Hiern's and De Candolle's descriptions. There is nothing in it to connect the species absolutely with *Lansium*, the genus in which its author has placed it.

9. *WALSURA*, Roxb.

Trees. *Leaves* 1-9-foliolate; leaflets opposite, entire, pale beneath. *Panicles* axillary and terminal; *Flowers* small, hermaphrodite. *Calyx* short, 5-fid or -partite, the lobes spreading, imbricated in bud. *Petals* 5, ovate-oblong, spreading, slightly imbricated or sub-valvate. *Filaments* 10 or 8, linear or flattened, free or connate in a tube; *anthers* terminal or inserted in the notch at the apex of the filament. *Disk* usually annular, fleshy. *Ovary* short, 2-3-celled, imbedded in the disk, style rather short; *stigma* turbinate-capitate, 2-3-dentate; *Ovules* 2 in each cell. *Fruit* baccate, shortly tomentose, indehiscent, 1- rarely 2-celled and -seeded; seed inclosed in a fleshy aril, exalbuminous. *DISTR.* about 12 species, Indo-Malayan.

Filaments united near the base.

Leaflets 5 to 9, with 5 or 6 pairs of main

lateral nerves ... 1. *W. multijuga*.

Leaflets not more than 5, with 8 to 10
pairs of main lateral nerves.

Stigma discoid, fruit not apiculate 2. *W. neurodes*.

Stigma conical, with a large swollen
annulus round its base; fruit
apiculate ... 8. *W. Candollei*.

Filaments quite free.

Leaflets five, 5 to 7 in. long, glaucous
beneath, flowers 15 in. long ... 4. *W. hypoleuca*.

Leaflets three to five, 3 to 5 in. long,
not glaucous; flowers 25 in. long .. 5. *W. robusta*.

1. *WALSURA MULTIJUGA*, King n. sp. A tree 20 to 30 feet high: young branches cinereous, puberulous, not lenticellate. *Leaves* 5 to 9 in. long, rachis puberulous; leaflets 5 to 9, coriaceous, lanceolate or oblong-lanceolate, shortly acuminate, usually much narrowed but sometimes rounded and oblique at the base; both surfaces glabrous, the lower paler; main nerves 5 or 6 pairs, ascending, curved, slightly prominent on the lower surface: length 2.5 to 5 in., breadth .75 to 1.5 in., rarely 2 in., petiolules .15 to 2 in., the terminal 4 or 5 in. *Panicles* small, umbellate-cymose, pedunculate, much shorter than the leaves, clustered in the axils of the leaves or terminal, puberulous; the peduncles 1 to 2 in. long, the heads about 1 in. in diam. *Flowers* about .1 in. long, their pedicels shorter. *Calyx-teeth* short, broad, spreading. *Petals* 5, broadly elliptic, blunt, puberulous outside, longer than the calyx. *Stamens* 10, shorter than the petals, the filaments slightly united into a tube in the lower third, the upper two thirds free, flattened, bifid at the apex, glabrous outside, pubescent inside below the anthers. *Anthers* small, ovate, inserted between the divaricating incurved teeth of the filaments. *Disc* proper, none. *Ovary* broadly obovoid or ovoid-globular, tapering into the very short style, glabrous; *stigma* small, capitate with a central mammilla. *Fruit* ovoid or ovoid-globose, apiculate, densely rusty-tomentose, .5 in. long without the apiculus. *Melospermum rubro-stamineum*, Scort. MS. in Herb. Calo.

Perak: Scortechini, Wray, King's Collector, very common. **DISTRIB.** Sumatra, Upper Burma.

2. *WALSURA NEURODES*, Hiern in Hook. fil. Fl. Br. Ind. I, 584. A tree; young branches cinereous-puberulous. *Leaves* 6 to 8 in. long; leaflets 5, narrowly elliptic or elliptic-oblong, shortly and bluntly acuminate, the base cuneate or rounded; upper surface glabrous, shining, the lower glaucous; main nerves 8 to 10 pairs, spreading, rather prominent beneath; length 2 to 4 in., breadth 1 to 2 in., petiolule .25 to .35 in., the terminal one 1 in. *Panicles* equal to or longer than the leaves, on rather long peduncles, their lateral branches lax, short, the flowers near their apices and not numerous. *Flowers* .15 in. long, pedicels shorter. *Calyx* with 5 short broad ovate spreading teeth. *Petals*

5, broadly elliptic, blunt, glabrescent inside, puberulous outside. *Stamens* 10, shorter than the petals; the filaments flattened, pubescent, faintly united in their lower third but easily separable, inserted outside the annular entire glabrous disc. *Ovary* pubescent, surrounded by the disc, ovoid-conic, tapering into the thick glabrous style; *stigma* discoid, small. *Fruit* ovoid or ovoid-rotund, minutely puberulous, not apiculate, about .65 in. long. C. DC. Monogr. Phaner. I, 636.

Malacca: Maingay (Kew Distrib.), Nos. 344 and 345. Griffith, No. 1057 (Kew Distrib.). Perak: Wray, No. 3798.

3. *WALSURA CANDOLLEI*, King, n. sp. A small tree; young branches glabrous, lenticellate, dark-coloured when dry. *Leaves* 4 to 7 in. long, unequally pinnate; leaflets usually 5, membranous, lanceolate, sub-acute, the base rounded; both surfaces glabrous, the lower pale, sub-glaucous; main nerves 7 to 11 pairs, spreading, curving; length 2 to 4 in., breadth .75 to 1.2 in., petiolules .2 to .4 in. *Panicles* puberulous, crowded towards the ends of the branches, axillary, on slender pedicels 2 to 3 in. long, corymbosely cymose, about 1.5 in. across. *Flowers* .1 in. long, sub-globular, on pedicels about as long as themselves. *Calyx* of 5, free ovate concave spreading sepals, pubescent externally. *Petals* 5, much larger than the sepals, elliptic-ovate, sub-acute, puberulous. *Stamens* 10, the filaments united into a tube in their lower third, pubescent, the alternate shorter, all inserted outside the thick glabrous annular disc. *Anthers* attached to the apices of the filaments, broadly ovate, short, sparsely pubescent. *Ovary* pubescent, conical, surrounded by the disc. *Style* short, ob-conical; *stigma* conical, surrounded at the base by a projecting fleshy annulus. *Fruit* ovoid-globose, with a slightly curved conical apiculus, densely but minutely rusty-puberulous, .75 in. long.

Andaman Islands; Kurz, King's Collector.

This species is allied to *W. neurodes*, Hiern, from which it differs in its more hairy petals and stamens, thicker style, more conical stigma and apiculate fruit. I dedicate the species to M. Casimir De Candolle, who first detected it as new from fragmentary specimens sent to him by the late Mr. Kurz. M. De Candolle did not include it in his Monograph of *Meliaceae* (Monogr. Phaner. Vol. I), but kindly communicated the fact of his discovery to me. Specimens since sent to me by the collectors of the Calcutta garden confirm the accuracy of his decision.

4. *WALSURA HYPOLEUCA*, Kurz Rep. Veg. Andam. ed. 2, p. 33. A tree 40 to 50 feet high; young branches stout, puberulous, lenticellate. *Leaves* 12 to 14 in. long, glabrous; leaflets 5, thinly coriaceous, elliptic-oblong, sub-acute, the base cuneate; upper surface shining, the lower glaucous; main nerves 7 or 8 pairs, ascending, prominent beneath;

length 5 to 7 in., breadth 2 to 3 in., the terminal one a third larger and with more nerves; petiolules .75 in., that of the terminal leaflet 2 in. *Panicles* several from an axil, 4 to 6 in. long, pubescent, the branchlets short and slender with the flowers crowded near their apices. *Flowers* .15 in. long, on short puberulous pedicels. *Calyx-tube* 5 or 6, elongate, ovate or lanceolate, puberulous. *Petals* 5, longer than the calyx, elliptic-obtuse, erect, puberulous. *Stamens* 10, distinct, inserted outside the disc, shorter than the petals; the filaments flattened, but not quite so broad as the ovate anthers, sparsely villous. *Disc* annular, cushion-like, entire, glabrous, surrounding the ovoid-conic, villous, ovary. *Style* cylindric, thickened upwards, glabrous; *stigma* discoid. *Unripe fruit* (*fide* Kurz) "oblong, acuminate, greyish-velvety." Kurz in Journ. As. Soc. Bengal, Vol. 41, Pt. 2, p. 296; For. Flora Burma I, 224; Hiern in Hook. fl. Fl. Br. Ind. I, 564. C. D. Cand. Monogr. Phaner. I, 639

Andaman Islands: at Port Mowat

This has been collected only by Kurz and I have never seen its fruit. I believe Kurz's species *C. oxycarpa* is merely a small-leaved form of this. Kurz distinguishes it from this by its thinner leaves and fainter venation,—characters of little value, I fear.

5. *WALSURA ROBUSTA*, Roxb. Hort. Beng. 32: Fl. Ind. II, 386. A tree 40 to 60 feet high; young branches slender, lenticellate, glabrous. *Leaves* 7 to 12 in. long. *Leaflets* 3 to 5, sub-coriaceous, ovate-oblong to ovate, entire, bluntly acuminate, the base narrowed; both surfaces glabrous, the upper shining, the lower dull with the 6 or 7 pairs of curving nerves rather prominent; length 3 to 5 in., breadth 1.75 to 2.25 in.; petiolules about .5 in., that of the terminal leaflet 1.5 in. *Panicles* dense, many-flowered, shorter than the leaves, cinereous-puberulous; bracts (if any) deciduous. *Flower-buds* hemispheric, tomentose, subsessile. *Petals* .2 in. long (larger than the sepals). *Stamens* 10; the filaments flattened, lanceolate, puberulous, free from each other, inserted outside the broad, thin, sub-concave, pubescent disk. *Ovary* depressed-globose, crowned by the thick style, 2-celled, with 2 ovules in each cell; *stigma* discoid with a central mammilla. *Fruit* elliptic or globular, .75 in. in diam., when dry capsular, 2-celled, but one of the cells empty. *Seed* pendulous, testa membranous, albumen 0; the cotyledons fleshy, plano-convex; the radicle short, superior. Hiern in Hook. fl. Fl. Br. Ind. I, 565; Kurz For. Fl. Burm. I, 223; C. De. Cand. Monogr. Phaner. I, 638; Wall. Cat. 8110, 8111, 8112. *Surwala robusta*, Boem. Synops. i. 108. *Monocycalis robusta*, Wall. ex Voigt Hort. Suburb. Calcutta 135. *Scytalia glabra*, Hb. Ham. ex Wall. Cat. 8048 E, (not the other letter.)

Andaman Islands: very common. DISTRICT. Brit. India, in Burma, Silhet, Assam, Sikkim.

10. HEYNEA, Roxb.

Trees or rarely shrubs. *Leaves* 5-11-foliolate; leaflets opposite, entire. *Panicles* terminal and axillary, corymbose, long-peduncled; *Flowers* rather small, hermaphrodite. *Calyx* short, 4-5-fid, the lobes imbricate. *Petals* 4-5, oblong, suberect, sub-imbricate. *Staminal tube* 8- or 10-fid; lobes linear, bidentate at apex, bearing the anthers between the linear teeth. *Disk* annular, fleshy. *Ovary* immersed in the disk, 2-3-celled, narrowing into the short style; *stigma* 2-3-dentate, with a thickened ring at the base; *ovules* 2 in each cell. *Fruit* capsular, 1-celled, 2-valved, 1-seeded, glabrous. *Seed* arillate, exalbuminous; aril thin, white; cotyledons hemispherical.—DISTRICT. 1-3 species, limited to Indo-Malaya.

HEYNEA TRIJUGA, Roxb., Hort. Beng. 33. A small tree 15 to 20 feet high. *Leaves* 6 to 16 in. long; leaflets broadly ovate to ovate-lanceolate, shortly acuminate, the base rounded or cuneate; upper surface glabrous, the lower surface glaucous, glabrous or pubescent; the 6 to 8 pairs of curving spreading nerves slightly prominent; length 2.5 to 5.5 in., breadth .3 to 2.75 in., petiolule .15 to .45 in., the terminal ones longer. *Panicles* glabrous as long or nearly as long as the leaves, on long peduncles, with numerous corymbose branches. *Flowers* .15 in. long. *Petals* much longer than the calyx, their midribs thick, their edges membranous. *Staminal tube* wide. *Ovary* glabrous. *Fruit* ovoid, beaked; the pericarp somewhat fleshy, smooth, splitting by 2 rarely 3 valves. Roxb. in Bot. Mag. t. 1738; Corom. Plants III, 260; Flor. Ind. II, 390; Grah. Cat. Bomb. Pl. 31; Adr. Juss. in Mem. Mus. xix t. 18, f. 17; Dals. & Gibs. Bomb. Fl. 38; Wall. Cat. 1258; Brandis For. Fl. 70. DC. Prod. I, 624; Monogr. Phaner. I, 713; Hiern in Hook. fil. Fl. Br. Ind. I, 565. *H. affinis*, Adr. Juss. l.c. 275; Beddome Fl. Sylvat. t. 134; W. & A. Prodr. i. 121. *Walsura (Heynea) pubescens*, Kurz in Journ. Asiat. Soc. Beng. xli. ii. 297. *Walsura trijuga* Kurz For. Fl. Burm. I, 225. *H. connaroides*, Wight ex Voigt Hort. Suburb. Calcutta 136.

Perak: common, and probably also in the other provinces.—DISTRICT. British India, Sumatra.

Var. *multijuga*. DC. Monogr. Phaner. I, 714. Leaflets 11, lanceolate. *H. quinquejuga*, Roxb. Hort. Calc. 90; Fl. Ind. II, 391. Wall. Cat. 1259. *H. Sumatrana*, Miq. Ann. Mus. Lugd. Bat. IV, 60; DC. Monogr. Phaner. I, 714.

Penang: Wallich, No. 1259. Curtis, No. 676.

11. CARAPA, Aubl.

Glabrous littoral trees. *Leaves* 2- or 4- or sometimes 6-foliolate; leaflets opposite, quite entire, the nerves faint. *Panicles* lax, axillary, cymose, flowers hermaphrodite. *Calyx* 4-fid, short. *Petals* 4, reflexed. *Staminal tube* urceolate-globose, 8-dentate, the teeth bi-partite: *anthers* 8, 2-celled, included, alternating with the teeth. *Disk* fleshy, cup-shaped, adherent to the base of the ovary. *Ovary* 4-celled, 4-sulcate, the cells 2-8-ovuled; *style* short, *stigma* discoid. *Fruit* capsular, sub-globose, large, 4-celled, 6-12-seeded; pericarp fleshy, dehiscent by 4 valves. *Seeds* large, thick, angular; testa hard, spongy, aril 0, hilum large, ventral; cotyledons amygdaloid.—DISTRIB. About 6 species, all tropical and usually littoral.

Leaves with broad blunt apex and narrow base, coriaceous; panicles stout; fruit as large as an orange ... 1. *C. obovata*.

Leaves with sub-acute apex and broad base, very thinly coriaceous; panicles slender. fruit 7 to 10 in. in diam. ... 2. *C. moluccensis*.

1. *CARAPA OBOVATA*, Blume Bijdr. 179. *Leaves* 3 to 6 in. long; leaflets 1 to 2 pairs, coriaceous, obovate to oblong, the apex broad, obtuse, rarely notched or sub-acute, the base narrowed; main nerves 6 to 9 pairs, length 3 to 4 in., breadth 1·35 to 1·75 in., petiolules ·2 to ·35 in. *Panicles* 1·5 to 2·5 in. long, stout, cymose, few-flowered. *Flowers* ·25 in. long, their pedicels ·3 to ·5 in. long, bracteolate. *Calyx-teeth* broad, rounded. *Petals* much longer than the calyx, broadly elliptic, the edges imbricate. *Ovary* broadly ovoid. *Fruit* the size of an orange, apiculate when young, but not when ripe. *C. DC.* Monogr. Phaner. I, 718: Seemann Flora Vitiensis p. 28. *C. moluccensis*, Kurz (not of Lamk. For. Flor. Br. Burma, I, 226: *C. moluccensis*, (in part,) Hiern in Hook. fil. Fl. Br. Ind. I. 567. *Xylocarpus obovatus*, A. Juss. Mem. Mel. p. 98; Miq. Fl. Ind. Bat. I, Pt. 2, p. 546.

Malacca: Maingay, (Kew Distrib.) No. 347; Griffith, No. 1099. Perak; Scortechini, King's Collector. South Andaman; Kurz, King's Collectors. Little Andaman: Prain. DISTRIB. Sunderbuns of Bengal: (Heinig) and others; Java and other islands of the Malayan Archipelago. Tropical Africa.

2. *CARAPA MOLUCCENSIS*, Lamk. Encyc. Meth. I, 621. *Leaves* 4 to 10 in. long; leaflets usually 2 pairs, thinly coriaceous, almost membranous, broadly ovate to ovate-oblong, sub-acute, the base broad, unequal; main nerves about 6 pairs, spreading; length 2 to 4 in., breadth 1·5 to 2·25 in., petiolules ·15 to ·25 in. *Panicles* 3 to 5 in. long, slender, with lax spreading few-flowered branches. *Flowers* as in the last, but

with rather broader petals and a shorter style. *Fruit* sub-globular, 7 to 10 in. in diam. Blume Bijdragen, 179; O. DC. Monogr. Phaner., I, 719; Don. Gen. Syst. I, 686; DC. Prod. I, 626; Bedd. Flor. Sylvat. t. 136; Seeman Flor. Viti, 38; Hiern in Hook. fil. Fl. Br. Ind., (in part.) I, 567. *C. indica*, A. Juss. Dict. Sc. Nat. VII, p. 31. *Xylocarpus granatum*, Willd. Spec. III, 328; A. Juss. Mem. Mel. p. 92, t. 20, No. 22; Roxb. Fl. Ind. II, 240; Wight and Arn. Prod. 121; Blanco Flor. Philipp. ed. 2, p. 207; A. Gray U. S. Exped. I, 243. *X. granatum*, Koenig, Miq. Fl. Ind. Bat. I, Pt. 2, p. 546; *X. Forstenii* Miq. Ann. Mus. Lugd. Bat IV, 62.

South Andaman Island; Kurz, King's Collectors. Great Coco Island; Prain. DISTRIB. Burma, Malayan Archipelago, S. India, Fiji Islands, Africa.

12. CHICKRASSIA, ADR. JUSS.

A tree with pari-pinnate leaves, alternate sub-opposite or opposite oblique entire leaflets, terminal panicles and 4-5-merous flowers. *Ovary* short, dentate. *Petals* oblong, free, imbricate, erect. *Staminal tube* cylindrical; its mouth with 10 short blunt teeth. *Antthers* 10, short, attached to the edge of the mouth and entirely exserted. *Disk* none. *Ovary* cylindrical, on a short stalk, 3-celled; the ovules numerous, in 2 rows in each cell; *style* very short, stout; *stigma* capitate. *Capsule* woody, 3-celled, loculicidal; the pericarp separating into two layers. *Seeds* numerous, flat, winged below, exalbuminous. A single species.

CHICKRASSIA TABULARIS, A. Juss. in Mém. Mus. XIX, 251, t. 22, f. 27. A tall tree; young branches stout, lenticellate, sub-glabrous. *Leaves* 12 to 18 in long; leaflets 10 to 16, ovate to oblong, unequal-sided, acute or acuminate; the base rounded on one side, narrowed on the other: upper surface glabrous, the lower glabrous or more or less velvety; length 2 to 5 in., breadth 1 to 2.5 in., petiolules .15 to .35 in. *Panicles* terminal, erect, shorter than the leaves; the branches spreading, pubescent, many-flowered. *Flowers* .4 to .5 in. long. *Ovary* with 5 short, shallow, broad teeth, pubescent outside. *Petals* pubescent outside, pubescent inside. *Capsule* ovoid, 1.75 in. long; seeds .65 in. long. W. and A. Prod. 123; Thwaites Enum. 61; Wight Ill. t. 56; Bedd. Fl. Sylvat. t. 9; Griseb. Cat. Bomb. Pl. 32; Kurz For. Flora Burm. I, 227; Hiern in Hook. fil. Fl. Br. Ind. I, 568; O. DC. Monogr. Phaner. I, 726. *Swietenia Chickrassia*, Roxb. Hort. Beng. 33; Fl. Ind. II, 399. *Plageotaxis Chickrassia*, Wall. Cat. 1269. *S. Sotrophola*, Ham. ex Wall. Cat. p. 214. *Chickrassia trilobularis* Roem. Syn. I, 135; Roxb. ex Buch. Journ. I, 184; G. Don. Gen. Syst. I, 688. *Cedrela* sp. Wall. Cat. 4892.

Var. *velutina*, leaflets, more or less velvety beneath. *♂. velutina*

Roemer Synops. fasc. I, p. 135; Kurz For. Flora Burma I, 227; C. DC. Monogr. Phaner. I, 717. *C. Nimmonii* Grah. in Wight Ill. 146; Dalm. and Gibs. Fl. Bombay, 38. *Plageotaxis velutina*, Wall. Cat. 1270. *Cedrela velutina*. DC. Prod. I, 625. ? *Cedrela villosa*, Roxb. Hort. Beng. 18. ? *Melia tomentosa*, Kurz Rep. Veg. Andam. ed. i. p. iv., (not of Roxburgh). ? *Toona velutina*, Roem. Synops. Monogr., i. 139. ? *T. villosa* Roem., l. c. 140.

Malacca: Maingay. Andaman Islands: King's Collectors. DISTRIB. Burma, British India, Ceylon.

13. CEDRELA, Linn

Tall trees with coloured wood. *Leaves* pinnate; leaflets numerous, opposite or sub-opposite, entire or serrate. *Panicles* terminal and sub-terminal. *Flowers* white, pentamerous. *Calyx* short, 5-cleft. *Petals* sub-erect, oval, imbricated, free. *Stamens* 5, free, inserted at the top of the disk, rarely alternating with staminiodes, filaments subulate. *Anthers* oblong, versatile. *Disk* thick or raised, 5-lobed. *Ovary* sessile on the top of the disk, 5-celled; *cells* alternate with the calyx-lobes, each with 8-12 bi-seriate pendulous ovules; *style* filiform; *stigma* discoid. *Capsule* coriaceous, 5-celled, septifragally 5-valved, *valves* consisting of two plates. *Seeds* compressed, winged at the apex or at both ends, with fleshy albumen; *cotyledons* flat, sub-foliaceous.—DISTRIB. About 16 species, inhabiting Tropical Asia, Australia, and America.

CEDRELA FEBRIFUGA, Forsten Diss. Cedrel. 16. A tree 80 to 150 feet high; young branches puberulous, lenticellate. *Leaves* 15 to 24 in. long, glabrous; leaflets membranous, 7 to 10 pairs, obliquely ovate-oblong, shortly and bluntly acuminate, the base broad and unequal-sided, the edges entire; main nerves 12 to 15 pairs, sub-horizontal, distinct beneath when dry; length 3.5 to 4.25 in., breadth 1.75 to 2 in., petiole .2 in. *Panicles* terminal, shorter than, or as long as the leaves, spreading, glabrous; their ultimate branches short, cymose, crowded. *Flowers* .2 in. in diam., on short pedicels. Segments of the calyx spreading, much shorter than the petals, obtuse, pubescent at the edges. *Petals* broad, obtuse, pubescent. *Stamens* 6, slightly shorter than the petals, the filaments and ovary sericeous. *Capsule* 1 in. long, lenticellate. *Seeds* winged at each end, .6 to .7 in. long. Blume Bijdr. I, 180; A. Juss. Mem. Mel. 103; Miq. Flor. Ind. Bat. V. I, pt. 2, 548; Suppl. 197; Ann. Mus. Lugd. Bat. IV, 63; De Cand. Monogr. Phaner. I, 744. *O. Toona*, Hiern (not of Roxb.) Hook. Fl. Br. Ind. I, 569. *Toona febrifuga*, Roem. Syn. fasc. I, 139.

Penang: Curtis, No. 826. Perak: King's Collector, No. 10403.

In the Flora of British India, Mr. Hiern has reduced this to J. n. 12

C. Toona, Roxb. And there is no doubt that the flowers of the two are very similar, differing chiefly in the hairiness of the petals and stamens of *C. febrifuga*. The panicles, however, of *C. febrifuga* are longer and their ultimate branches are shorter and denser than those of *C. Toona*. The capsules, moreover, are much longer (1 in. as against .6 in.). The flowers of all the species of *Cedrela* are very much alike. I hesitate therefore, to follow Mr. Hiern merely because very good distinctive characters cannot be had from the flowers, and I prefer to follow De Candolle in maintaining this as a species. The nearest ally of *C. febrifuga* is undoubtedly *C. microcarpa* C. DC.

Order XXVIII. CHAILLETIACEÆ.

Trees or shrubs. *Leaves* alternate, quite entire; *stipules* 2, deciduous. *Flowers* small, unisexual or polygamous, in corymbose cymes; *peduncles* sometimes adnate to the petiole. *Sepals* 5, free or connate, sometimes unequal, imbricate. *Petals* 5, free, sub-perigynous, equal or unequal, notched or 2-fid, with often an inflexed lamina which is adnate to the face of the petal, usually open in aestivation. *Stamens* 5, sub-perigynous, all or some only fertile, free or adnate to the corolla; *Anthers* oblong, connective often thickened at the back. *Disk* of 5 glands or scales, or a 5-glandular or -lobed cup. *Ovary* free, pubescent or villous, 2-3-celled; *styles* 1-2-3, free or more or less connate; *stigmas* simple or capitate; *ovules* anatropous, pendulous in pairs from the top of each cell. *Drupe* pubescent or hispid, oblong, transversely oblong or didymous, compressed; *epicarp* entire or dehiscent; *endocarp* indehiscent or not, 1-3-celled; *cells* 1-seeded. *Seed* pendulous, hilum broad, testa membranous, albumen 0; *embryo* large; *cotyledons* thick, radicle small, superior.—A small chiefly tropical order, of 3 genera and about 40 species.

1. CHAILLETIA, DC.

Flowers polygamo-monoecious. *Sepals* 5, unequal, united at the base or above it, obtuse. *Petals* 5, 2-lobed, narrow, free. *Stamens* 5, sometimes slightly adnate at the base to the petals. *Disk* of 5 quadrate scales placed opposite the petals. *Ovary* 2-3-celled.—**DISTRIB.** Tropical Asia, Africa, and especially America; species about 30.

Leaves oblong or elliptic, lanceolate.

Leaves very thin, quite glabrous; cymes globular, .25 in. to .4 in. in diam. ... 1. *C. tenuifolia*.

Leaves coriaceous, glabrous except the midrib, strigose at the base; cymes 1 to 2 in. in diam. ... 2. *C. Hookeri*.

- Leaves membranous, with many fulvous
bristles on the edges midribs and nerves 3. *O. Griffithii*.
- Leaves elliptic or oblong-elliptic
Midribs of leaves strigose beneath; cymes
·5 in. in diam.; ripe drupes ·65 in. broad 4. *O. Halferiana*.
- Midribs of leaves quite glabrous; cymes
·3 in. in diam.; ripe drupes 1·25 in. in
diam. 5. *O. Lauroceranus*.
- Leaves elliptic but more or less ob-lanceo-
late or obovate, glabrous 6. *O. andamanica*.
- Leaves elliptic-obovate, retuse, minutely tomen-
tose on the lower surface 7. *O. deflexifolia*
var. *tomentosa*.

1. *CHAILETIA TENUIFOLIA*, King, n. sp. A shrub, 6 feet high; young branches, angular, puberulous. Leaves thinly membranous, elliptic-lanceolate, tapering to either end, the apex shortly acuminate: both surfaces glabrous and reticulate; main nerves 5 to 8 pairs, ascending, curving and interarching boldly, depressed on the upper, prominent on the lower surface; length 6 to 8 in., breadth 2·25 to 2·75 in.; petiole ·15 in., strigose. Cymes small, globular, ·25 to ·4 in. in diam., axillary, solitary; their pedicels ·15 in., strigose. Flowers sub-globular, ·05 in. in diam. Sepals erect, elliptic, obtuse, minutely sericeous outside, glabrous inside. Petals shorter but broader than the sepals, glabrous, slightly bifid at the apex, the lobes sub-acute. Stamens shorter than the petals, the filaments slightly sericeous, shorter than the oblong innate anthers, connective slightly sericeous. Ovary ovoid, densely sericeous-lanate; style short. Ripe fruit deeply 3-lobed ·6 in. long and ·75 in. broad.

Perak: King's Collector, No. 3498.

This species shows no tendency to become scandent.

2. *CHAILETIA HOOKERI*, King, n. sp. A climber; young branches terete, puberulous at first, afterwards glabrous. Leaves coriaceous, oblong-lanceolate and acuminate (rarely oblong and obtuse or sub-acute), the base narrowed, reticulate and shining on both surfaces, glabrous except a few strigose hairs on the midrib near the base; main nerves 8 to 10 pairs, curving and interarching far from the edge; length 4·5 to 6·5 in., breadth 1·5 to 2 in.; petiole 25 in., strigose. Cymes axillary, usually in pairs, pedunculate, tomentose, dichotomous, spreading, 1 to 2 in. in diam., the peduncles ·5 to ·75 in. long. Flowers about 1 in. long. Sepals oblong, blunt, erect, concave, sericeous-tomentose outside, glabrous inside. Petals glabrous, shorter but broader than the sepals, deeply divided into two concave irregularly obovate overlapping

segments. *Stamens* about as long as the petals, glabrous; *anthers* adnate, blunt, broad, the cells on the edges of the connective. *Ovary* ovoid, densely lanate-sericeous; *style* elongate, thin. *Ripe drupe* unknown. Wall. Cat. No. 7443.

Penang: Porter. Perak: Scortechini.

This is the species referred to by Sir Joseph Hooker (Fl. Br. Ind. I, 572), as probably an undescribed species of *Chailletia*. The species, when Sir Joseph wrote, was known only by Porter's incomplete specimens. A few specimens of what is evidently the same plant were collected by the late Father Scortechini in Perak, and these have enabled me to describe the flowers. The fruit, however, still remains unknown.

3. *CHAILLETIA GRIFFITHII*, Hook. fil. Fl. Br. Ind. I, 571. A slender climber; young branches striate, dark-coloured when dry, clothed with numerous long, spreading, stiff, fulvous hairs with minute soft, short, white pubescence between. *Leaves* membranous, oblong-lanceolate, acuminate, the base rounded or minutely cordate; upper surface glabrous except the sparsely bristly midrib, the lower with numerous bristles on the midrib and a few scattered elsewhere chiefly on the nerves, the edges ciliate; main nerves 9 to 11 pairs, ascending, rather bold beneath; length 4 to 7 in., breadth 1 to 2 in., petiole .1 in., densely bristly. *Oymes* globular, axillary, sessile, densely bristly, .4 to .5 in. in diam. *Flowers* campanulate, nearly .25 in. across at the mouth. *Sepals* sub-erect, narrowly ovate, densely sericeous on the outer, and slightly pubescent on the inner surface. *Petals* glabrous, not longer than the sepals but broader, obovate, the apex shortly bifid, the lobes sub-acute, concavo. *Stamens* as long as the petals, the anthers short, broadly ovate, the cells anterior. *Ovary* ovate, densely lanate-sericeous; *style* shorter than the stamens; *stigmas* 3, small, truncate. *Ripe fruit* (fide Hooker) 1.5 in. long, 2-celled. *O. lanuginosa*, Maing. MSS.

Perak; King's Collector, No. 6117. Malacca; Griffith, No. 2169 (Kew Distrib.), Maingay, No. 370.

Griffith describes this as "a shrub." It is actually a climbing shrub 15 to 20 feet long. The flowers are white.

4. *CHAILLETIA HELPERIANA*, Kurz in Journ. As. Soc. Bengal, XLI, (1872), Pt. 2, 297. Scandent; young branches adpressed-yellowish pubescent, terete. *Leaves* thinly coriaceous, elliptic or oblong-elliptic, shortly and abruptly acuminate, the base cuneate, both surfaces reticulate (the lower rather obscurely so) and glabrous, the midrib strigose beneath; main nerves 7 or 8 pairs, spreading, faint; length 4 to 6 in., breadth 1.25 to 2.25 in.; petiole .25 in., strigose. *Oymes* solitary, axillary, about .5 in. in diam.; their pedicels about .3 in. long, strigose.

Flowers sub globular, less than .1 in. long. *Sepals* broadly ovate, blunt, sericeous on the outer, pubescent on the inner surface. *Petals* smaller than the sepals, elliptic, obtuse, shortly bifid, the lobes blunt. *Filaments* very short, the anthers ovate, the cells anterior. *Ovary* conical, laxly sericeous. *Ripe drupe* transversely oblong, compressed, .65 in. broad, and only .4 in. long, minutely tomentose. Hook. fl. Fl. Br. Ind. I, 570.

Langkani; Curtis, No. 1687.—DISTRIB. Burma, Wall. Cat. 4033. Tenasserim; Helfer (Kew Distrib.), No. 2172.

Curtis's Langkani specimens are in fruit only, and those of Helfer's Tenasserim collecting (the type of the species) are in flower only. But the two seem identical. I have not seen the Wallichian sheet No. 4033.

5. *CHAILETHIA LAUROCERASUS*, Planch. ex Hook. fl. Fl. Br. Ind. I, 572. A scandent glabrous shrub 30 to 40 feet long; young branches slender, dark-coloured. *Leaves* coriaceous, elliptic or elliptic-oblong, obtusely acuminate, the base narrowed, upper surface shining when dry, the lower paler; main nerves 7 or 8 pairs, spreading, faint; length 3.5 to 4.5 in., breadth 1.5 to 2.5 in., petiole about 1 in. *Cymes* axillary, globose, few-flowered, .3 in. in diam., shortly pedunculate. *Flowers* .15 to 2 in. in diam. *Sepals* hoary outside, glabrous inside, broadly ovate or orbicular, concave. *Petals* longer than the sepals, glabrous, oblong, out half way down into two oblong blunt concave slightly divergent segments. *Filaments* nearly as long as the petals; *anthers* shortly ovate. *Ovary* densely lanate-sericeous, broadly ovoid; *style* stout, *stigma* concave. *Drupe*s transversely oblong or globose, 1.25 in. in diam. when ripe, the epicarp hoary; *endocarp* thick, tubercled outside, 1- or 2-seeded. Wall. Cat. 7513, (*indeterminatus*).

Penang; common. Perak: King's Collector.

6. *CHAILETHIA ANDAMANICA*, King n. sp. A small tree; young branches pale-brown, lenticellate, puberulous. *Leaves* thinly coriaceous, elliptic-oblongate or elliptic-obovate, abruptly and shortly blunt-acuminate, much narrowed at the base; both surfaces glabrous, minutely reticulate, pale when dry; main nerves 4 to 6 pairs, much curved and interarching far from the edge, only slightly prominent on either surface; length 3 to 4.75 in., breadth 1.25 to 2.5 in., petiole .15 to .2 in. *Stipules* lanceolate, about as long as the petiole. *Flowers* in dense axillary shortly pedunculate dichotomous cymes. *Buds* ovoid-globular. *Sepals* 5, sub-rotund, very concave, hoary externally, much imbricate. *Petals* 5, quadrate, not bifid, glabrous, shorter than the sepals. *Stamens* shorter than the petals, the filaments very short, anthers ovate. *Rudimentary ovary* ovoid, compressed, hairy. *Female flowers* not seen. *Fruit* about .5 in. broad, and .4 in. depth, transversely oblong, much compressed, puberulous, divided into two lobes by a deep vertical groove,

2-celled, 2-seeded, (often from the abortion of one of the cells) ovoid, 1-celled and 1-seeded.

South Andaman Island; King's Collectors.

The greatest breadth of the leaves in this species is above the middle, and in this respect it differs from *O. gelonoides*. The point of the leaves is also shorter than in that species; the flowers are less hairy, the cymes less crowded, and they are pedunculate and not sessile as in *O. gelonoides*.

7. *CHAILETTIA DEFLEXIFOLIA*, Turcz. in Bull. Mosc. 1863, pt. 1, 611, var. *tomentosa*. A climber, 10 to 30 feet long; young branches densely and minutely olivaceous-tomentose. *Leaves* thinly coriaceous, elliptic-obovate, retuse; upper surface minutely reticulate when dry, glabrous when adult except the minutely tomentose midrib and nerves; lower surface softly and minutely pilose, the midrib tomentose as are the 5 to 7 pairs of curved, spreading, main nerves; length 4·5 to 6·5 in., breadth 2·5 to 3·25 in., petiole ·3 to ·4 in. *Cymes* axillary, and often terminal, pedunculate, tomentose, dichotomous, spreading, often 3 in. in diam.; the peduncles 1 to 1·25 in. long, stout. *Flowers* ·25 in. in diam. *Sepals* oblong-lanceolate, deflexed, sericeous-tomentose outside, glabrous inside. *Petals* as long as the sepals, deeply divided into 2 lanceolate segments. *Stamens* as long as the petals, the anthers shortly ovate. *Ovary* densely lanate-sericeous, depressed globular, the style slender, stigma small. *Drupe*s compressed, rotund-reniform, sericeous, rugose, pitted, 1 in. broad; the endocarp very hard, 2-celled, 2-seeded. Hook. fil. Fl. Br. Ind. I, 571; Wall. Cat. 9016 (*indeterminata*).

Malacca; Griffith, Maingay. Perak; King's Collector, Wray, Soortechini.

Order XXIX. OLACINÆ.

Trees or shrubs, rarely herbs, sometimes climbing. *Leaves* alternate, rarely opposite, simple or lobed, penni- or palmi-nerved, exstipulate. *Inflorescence* cymose or racemose, rarely capitate, terminal, axillary or extra-axillary, sessile or more or less peduncled. *Flowers* regular, hermaphrodite, polygamo-dioecious or dioecious. *Ovary* usually small, 4–5-toothed, sometimes accrescent, free or adherent to the fruit, lobes valvate or imbricate. *Petals* 3–6, valvate or imbricate, free, or more or less coherent. *Stamens* 3–15, inserted with the petals, free or adnate to them and either opposite to or alternate with them, all fertile, or some (staminodes) anatherous, disunited or more or less monadelphous. *Anthers* erect, 2-celled, dehiscing longitudinally. *Disc* hypogynous or perigynous, cup-shaped, often absent. *Ovary* free, or half inferior, 1-celled or imperfectly 2–3–5-celled (from the dissepiments not

reaching the apex of the cavity). *Style* simple or 0, rarely divided; *stigma* 1 rarely 2, entire or lobed; *ovules* 1-5, pendulous from the apex of a minute free central placenta, or from the side or apex of the ovarian cavity; *funicle* (or placenta?) often dilated into a thickened process above the ovule. *Fruit* drupaceous or dry, indehiscent, 1- rarely 2-celled, 1- rarely 2-seeded, free, or more or less adnate to the calyx-tube and disk. *Seed* pendulous; albumen fleshy, entire or lobed, rarely 0; *radicle* superior; *cotyledons* leafy, flat or folded, rarely fleshy.—*DISTRIB.* Genera about 45, species about 220, widely distributed through the Tropics of both hemispheres.

The *Olaceæ* are rather an assemblage of plants than a Natural Order. The solitary character which is common to all the species included under the title is pendulous ovulation; and even that character is obscured by the fact that, in a number of the genera, the ovules are pendulous from the apex of a minute free central placenta which does not grow as the pistil develops, so that the seeds are erect in the fruit and have the appearance of originating from a basal placenta. In the remaining genera, both ovules and seeds are unmistakably pendulous from the apex, or from near the apex, of the cavities of the ovary and fruit. The majority of the genera have hypogynous stamens and superior fruit. But in *Erythrophalum* the stamens are perigynous and the fruit is inferior; while *Canejera* and *Lepionurus* have their stamens perigynous in the flower, but the fruit (from the development of the fertilized pistil in a downward direction) is most distinctly inferior. In by far the greater majority of the species the stamens are free from each other, or, at the most, are slightly coherent by their bases: but in *Harmandia* the sessile anthers are attached near the mouth of a fleshy staminal tube like that found in *Melacææ*; and this tube, in an anantherous condition, is found in the pistillate flowers. By far the greater number of the genera have both calyx and corolla; but in *Canejera* and *Lepionurus* the perianth is single, and in *Phytocrene* and *Miquelia* the organs which take the place of the outer whorl of the flower appear to be rather bracts than a true calyx. In most of the genera the petals are really free from each other; for, although many of them cohere by their edges for a time, they ultimately become separate; while in a smaller number there is genuine cohesion near their bases. In *Harmandia* however the corolla is gamopetalous and urceolate at all times and its texture is fleshy.

All the genera treated of below are woody except *Cardiopteris* which is herbaceous, and which moreover has milky juice. And all the genera have alternate leaves except *Otenolophon* in which the leaves are opposite. The whole order appears to me to be in want of revision: and the study of the species described below leads me to incline to the opinion that several of the sub-tribes would be better treated as distinct natural orders; while one (*Opilææ*) might be transferred to *Bentalacææ*.

FRUIT DRUPACEOUS: STIGMA 1.

Ovules pendulous from the apex of a minute axile placenta; seed spuriously erect.

Dichlamydeous, ♂: fruit superior.

Sub-Tribe I.—*Olaceæ*. Stamens aniso-

merous, twice as many as or equal to and opposite the petals: ovary 2- to 5-celled at the base, 1-celled at the apex, or simply 1-celled.

Fruit superior.

Calyx much enlarged in the fruit.

Fertile stamens 3 to 5, not in a tube 1. *Olas*.

Stamens 4, the filaments forming a fleshy tube 2. *Harmandia*.

Calyx not enlarged in the fruit

Fertile stamens 12 to 15 3. *Ochanostachys*.

Fertile stamens 5 4. *Bracea*.

Fruit inferior 5. *Strombosia*.

Monochlamydeous, ♀; fruit inferior.

Sub-Tribe II.—*Opilicæ*. Stamens equal in number to the segments of the perianth and opposite to them; ovary 1-celled, 1-ovuled.

Scandent 6. *Oanajera*.

Shrubby 7. *Lepionurus*.

Ovules and seeds pendulous from the apex of the ovary and fruit.

* Stamens hypogynous.

Sub-Tribe III.—*Ximenias*. Stamens as many as or twice as many as the petals; ovary 2- to 4-celled at the base, 1-celled at the apex.

Leaves opposite 8. *Otenolophon*.

Leaves alternate.

Fertile stamens 10.

Stamens hypogynous, free from the petals 9. *Ximenia*.

Stamens attached by pairs to the petals 10. *Scorodocarpus*.

Fertile stamens 6, concealed in the concavities of the petals 11. *Anacolosia*.

Sub-Tribe IV.—*Isacineæ*. Flowers dichlamydeous, ♀, or polygamo-dioecious: stamens equal in number to the petals and alternate with them; ovary 1- rarely 2-celled, ovules 2 (rarely 1).
Shrubs or trees,

Ovary and fruit 1-celled.

Flowers polygamo-dioecious;
ovary in female flowers cylindric,
with large sessile discoid stigma.

Sepals 5, distinct, imbricate;
male flowers in short axillary
interrupted glomerulose
spikes ... 12. *Platea*.

Calyx cupular, 4 5-toothed,
flowers in cymes ... 13. *Gomphandra*.

Flowers hermaphrodite, stigma
minute ... 14. *Lisianthera*.

Ovary and fruit 2-celled the cells
1-ovulate (1 cell aborting) ... 15. *Gonocaryum*.

Sub-Tribe V.—*Phytocrenae*. Flowers
monoecious or dioecious, mono-ordi-
chlamydeous, 4- or 5-merous (the pieces
imbricate) · stamens equal in number
to and alternate with the segments
of the perianth in the monochla-
mydeous, and with those of the corol-
la in the dichlamydeous species ovary
1-celled, ovules 2. Scandent shrubs.

Flowers monochlamydeous.

Flowers 4-merous, those of both
sexes in capitules, bracteoles
close to the flower, drupe
bristly ... 16. *Phytocrens*.

Flowers 5-merous, the males
umbellate, the females capi-
tate, bracteoles separated
from the flower by a long
stalk; drupe not bristly ... 17. *Miquelia*.

Flowers dichlamydeous.

Flowers sessile in long pendulous
interrupted spikes; filaments
longer than the anthers:
drupe pulpy ... 18. *Sarcostigma*.

Flowers in cymose panicles;
filaments shorter than the
anthers; drupe with very
little, if any, pulp ... 19. *Iodes*.

** Stamens perigynous.

Sub-Tribe VI.—*Erythropales*. Flowers dichlamydeous, ♂. Petals 5, perigynous, the stamens as many as and inserted opposite to them. Ovary half-immersed in the perigynous disk, 1-celled, with 1 to 3 ovules. Fruit inferior, crowned by the persistent calyx-lobes and by the disc, pericarp splitting vertically into 3 to 5 pieces.

Scandent tendril-bearing shrubs ... 20. *Erythropalum*.

FRUIT SAMAROID; STIGMAS 2.

Sub-Tribe VII.—*Cardiopterides*. Flowers dichlamydeous, ♂: corolla gamopetalous, the stamens equal to and alternate with its segments; ovules pendulous; stigmas 2, one at least of them persistent at the apex of the samaroid fruit.

Trees; ovary 2-celled, with 1 ovule in each cell, fruit 2-celled ... 21. *Pteleocarpa*.

Herbs; ovary 1-celled, ovules 2 (1 usually abortive), fruit 1-celled, juice milky ... 22. *Cardiopteris*.

1. OLAX, Linn.

Trees or shrubs, often scandent, sometimes armed. *Leaves* alternate, petioled, simple. *Racemes* axillary, simple, or branched. *Bracts* minute. *Calyx* minute, cup-shaped, truncate or obscurely toothed, accrescent. *Petals* 4 or 5, hypogynous, valvate, free or more or less coherent. *Fertile stamens* usually 3, generally opposite the edges of the petals and attached to their bases, rarely opposite their centres; *anthers* adnate to the filaments, oblong, 2-celled, dehiscing longitudinally. *Staminodes* 5-6, bifid, usually opposite the petals. *Ovary* free, usually surrounded by a shallow, cup-shaped, hypogynous disk, more or less 3-celled below, 1-celled above; *style* simple, terminal, stigma 3-lobed; *ovules* 3, linear, pendulous from the apex of a central placenta. *Fruit* more or less covered by the accrescent fleshy calyx; *stone* crustaceous, 1-celled, 1-seeded. *Seed* inverse, albuminous; *embryo* minute, in the apex of albumen; *radicle* superior.—*DISTRIB.* 25-30 species, natives of the tropics of the Old World.

1. OLAX IMBRICATA, Roxb. Fl. Ind. I, 164. A scandent unarmed

shrub; young branches terete, puberulous when very young. *Leaves* coriaceous, oblong-lanceolate to ovate-oblong, acute, the base rounded or narrowed; both surfaces glabrous, the upper shining, reticulate, the lower dull and the nervation indistinct; main nerves 8 or 9 pairs, faint, spreading; length 3.5 to 5.5 in., breadth 1.25 to 2.75 in., petiole .2 to .35 in. *Racemes* about .5 in. long, many-flowered; the bracts rather large, ovate, concave, imbricate when young, deciduous. *Flowers* about .5 in. long; petals 6, united in pairs. *Fertile stamens* 3, about as long as the pale staminodes. *Fruit* sub-globose, the apex truncate, .5 in. in diam., enveloped except at the apex by the accrescent calyx. Wall Cat. 6775; A. B. Decaisne Nouv. Ann. Mus. III, 498; Miq. Fl. Ind. Bat I, Pt. I. 785; Hook. fil. Fl. Br. Ind. I. 577; Kurz For. Flora Burma I, 234; Valetou, Olacineæ, 115.

Andaman and Nicobar Islands, Malacca. *DISTRIB*: Java, Philippines, Burmah, Chittagong.

Although I have not included *O. merguensis*, Planch as a synonym of this, I cannot see how it can be specifically separated. *O. Wightiana*, Wall. also appears to me to resemble this too closely to be kept distinct as a species.

2. HARMANDIA, Pierre.

Trees with alternate, simple, entire, petiolate leaves. *Flowers* unisexual, racemose, pedicellate, solitary in the axils of bracteoles. *Calyx* cupular, entire or 4-toothed, greatly enlarged and persistent in the fruit. *Corolla* campanulate or urceolate, fleshy, with 4 short acute valvate lobes (in the female flowers 6-to 8-lobes?) *Disc* short, thin, annular, crenulate, deciduous, embracing the outside of the base of the cylindric staminal tube. *Anthers* 4, sessile, inserted at the mouth of the thick fleshy staminal tube opposite the teeth of the corolla, bilocular, introrse, the apices reflexed, the connective thick. *Pistil* superior, pyramidal, surrounded in the female flower by the barren staminal tube, 1-celled; *stigma* 3-lobed, sessile; *ovules* 2 (usually only 1), short, free, descending from the apex of the short trigonous central placenta. *Drupe* oblong, 1-seeded, surrounded at the base by the large, fleshy, spreading, coloured accrescent calyx; *epicarp* fleshy, *endocarp* ligneous. *Seed* solitary, filling the cavity of the fruit, its testa thin and inseparable from the fleshy albumen, *embryo* minute, excentric, oblique, near the apex of the albumen. *Cotyledons* flat, shorter than the radicle. *DISTRIB.* 2 species; both Malayan.

This genus founded by M. Pierre (Bull. Soc. Linn. Paris, No. 97, p. 770), is remarkable in having a fleshy staminal tube very like that of some *Meliaceæ*, and for the enormous development of the accrescent calyx which forms a large coloured collar round the ripe fruit.

1. *HARMANDIA KUNSTLERI*, King, n. sp. A glabrous tree 30 to 40 feet high; young branches slender, striate. *Leaves* coriaceous, ovate-lanceolate or lanceolate, shortly and bluntly acuminate, the base cuneate; main nerves about 6 pairs, very indistinct on both surfaces; length 2·5 to 3·5 in., breadth 1 to 2 in., petiole ·25 to ·5 in. *Racemes of female flowers* axillary, solitary, not much longer than the petioles. *Flowers* ·15 in. long, solitary in the axils of oblong obtuse bracteoles. *Calyx* flat, spreading, with 4 very obtuse teeth. *Corolla* four times as long as the calyx, urceolate; teeth 4, acute. *Ovary* hidden (except the stigmas) by the barren staminal tube and by the corolla, pyramidal, the style short; 1-celled with a single spuriously erect ovule: *stigma* solitary, capitate. *Fruit* oblong, obtuse, 1·25 in. long, and ·6 in. in diam., surrounded at the base by the greatly enlarged coloured corrugated calyx which forms a frill 3 to 4 in. in diam.

Perak; King's Collector.

A very striking plant. The accrescent calyx forms an enormous waxy collar round the base of the fruit which, at first green, changes into a beautiful flesh-colour, the central part being bluish-black. This species is closely allied to *Harmandia mekongensis*, Pierre (For. Flora Coch. China, t. 264), from which it differs in having an urceolate (not tubular-campanulate) corolla and a larger fruit with the accrescent calyx less invaginated at the base.

3. *OCHANOSTACHYS*, Mast.

Trees or shrubs. *Leaves* alternate, petiolate, penni-nerved. *Flowers* numerous, on long slender branching axillary spikes. *Calyx* cup-shaped, 4-5-toothed, not accrescent. *Petals* 4-5, free, valvate. *Stamens* 12-15, hypogynous, or adherent to the base of the petals; filaments subulate, glabrous; *anthers* 4-celled, opening longitudinally; *staminodes* 0. *Disk* hypogynous, fleshy, very shallow, annular, inconspicuous; *ovary* free, sub-hemispheric, incompletely 3-celled beneath, 1-celled above; *style* short, cylindric; *stigma* minute, terminal, 3-lobed; *ovules* 1 in each cell, pendulous from the apex of a central placenta. *Fruit* drupaceous, 1-celled, 1-seeded.—*DISTRIB.* Species 1 or 2; natives of the Malay Peninsula and Borneo.

1. *OCHANOSTACHYS AMENTACEA*, Mast. in Hook. fil. Fl. Br. Ind. I, 579. A tree 30 to 40 feet high; young branches glabrous, the tips alone puberulous. *Leaves* thinly coriaceous, elliptic-oblong, entire, bluntly sub-acuminate, the base slightly narrowed, both surfaces glabrous; main nerves 5 (rarely 4) pairs, ascending, prominent on the lower, depressed on the upper surface when dry; length 3 to 5 in., breadth 1·5 to 2·5 in., petiole ·5 to ·75 in. *Racemes* as long as or longer

than the leaves, narrow, sometimes branched, axillary, interrupted. *Flowers* on short pedicels with minute ovate, acute bracts at the base; oblong-ovate in bud, less than $\frac{1}{2}$ in. long. *Petals* ovate, glabrous outside with a few coarse hairs inside. *Ovary* vertically striate. *Fruit* ovoid-pyriform, 1.25 in. long, and $\frac{1}{8}$ in. in diam.; the pericarp glabrous, thin, the endocarp bony, with one large cell and a single seed. *Valeton*, *Olacineæ*, 104. *Petalunia bancana*, Beccari in *Malasia*, I, 257.

In all the provinces except the Andaman and Nicobar Islands. Common.—DISTRIB. Borneo.

This is a very common tree in the Malayan Peninsula where its vernacular name is "Petalang". The same name is applied to it in Borneo, and of this name Beccari's *Petalunia* is an adaptation.

4. BRACEA, nov. gen. King

Arboreous; *leaves* alternate, simple, entire, petiolate. *Panicles* few-branched, axillary or terminal, nearly as long as or longer than the leaves. *Flowers* hermaphrodite, small, shortly pedicelled, scattered or sub-glomerulate, minutely bracteolate. *Calyx* of 5, free, imbricate, broad, non-acrescent, campanulate sepals. *Petals* 5, hypogynous, slightly united at the base, much imbricate, glabrous. *Stamens* 5, opposite the petals; filaments shorter than the anthers, very broad. *Anthers* ovate, innate, 2-celled, with introrse longitudinal dehiscence. *Staminodes* none. *Ovary* broadly ovate, pyramidal, tapering to the short style, imperfectly 2-celled at the base, 1-celled towards the apex; *stigma* small, 2-lobed. *Ovules* 2, from a short axile basilar placenta. *Fruit* drupaceous, 1-celled, with a single spuriously erect seed.

A genus near *Ochanostachys*, Oliver; but with only 5 stamens, very different in form from those of that genus. I dedicate this to Mr. L. Brace, formerly Curator of the Calcutta Herbarium.

1. *BRACEA PANICULATA*, n. sp., King. A glabrous tree 50 to 70 feet high; young branches dark-coloured, smooth. *Leaves* coriaceous, ovate to elliptic, sub-acuminate, the base rounded; upper surface shining, the lower dull; main nerves 7 or 8 pairs, curved, spreading, slightly prominent beneath when dry; length 3.5 to 8.5 in., breadth 1.85 to 2.75 in., petiole $\frac{1}{6}$ to $\frac{1}{8}$ in. *Panicles* with few, spreading, spike-like branches. *Flowers* $\frac{1}{2}$ in. long, on pedicels of about the same length, glabrous, the calyx half as long as the corolla; petals and sepals broadly ovate. *Stamens* shorter than the petals, glabrous; *disk* hypogynous. *Fruit* drupaceous, ellipsoid, blunt, glabrous (unripe), $\frac{1}{4}$ in. long, and $\frac{1}{8}$ in. in diam.; the calyx persistent at its base, but not accrescent; *pericarp* fleshy, *endocarp* leathery. *Seed* solitary, attached to the base of the cell.

Perak; Soortechini, No. 288, King's Collector, No. 8086.

5. STROMBOSIA, Blume.

Trees or shrubs. *Leaves* alternate, petioled, simple, penni-nerved. *Inflorescence* shortly cymose. *Flowers* regular, hermaphrodite. *Calyx* a shallow cup, more or less 5-lobed, inferior (partly superior in some species). *Petals* 5, free, hairy within. *Stamens* 5, opposite the petals and adnate to their bases. *Anthers* 2-celled, introrse. *Staminodes* 0. *Ovary* wholly superior, or (in some species) partly inferior, imperfectly 4- 5-celled, surrounded by a perigynous lobed disk. *Style* simple. *Ovules* 4-5, pendulous from a central placenta. *Fruit* drupaceous, surmounted by the remains of the calyx-lobes and of the style, stone crustaceous. *Seed* pendulous, embryo minute within fleshy albumen. *DISTRIB.* Species 6, natives of the Western Peninsula, Ceylon and the Malayan Archipelago.

Flowers in pedicelled few-flowered cymes ... 1. *S. javanica*.

Flowers in sessile many-flowered fascicles ...

Leaves ovate to oblong-ovate; petals .2 in.

long 2. *S. multiflora*.

Leaves more or less rotund; petals .15 in.

long 3. *S. rotundifolia*.

1. STROMBOSIA JAVANICA, Blume Bijdr. 1154. A tree 20 to 50 feet high; young branches rather slender, glabrous. *Leaves* thinly coriaceous, glabrous, oblong to elliptic, shortly acuminate, the base rounded; main nerves 5 or 6 pairs, curved, ascending, slightly prominent beneath; length 4 to 7 in., breadth 1.65 to 2.65 in., petiole .6 to .75 in. *Cymes* axillary, not longer than the petioles, few-flowered; bracteoles small, deciduous, leaving pale scars. *Flowers* ellipsoid in bud, about .2 in. long. *Calyx* nearly flat with 5 short lobes, inferior in the flower; (accrescent and half inferior in the fruit). *Petals* erect, much exceeding the calyx, oblong, obtuse, hairy towards the apex. *Stamens* 5, opposite to, nearly as long as, and adhering to the petals. *Ovary* elongate, tapering into the short style. *Fruit* oblong-ovoid, glabrous, .8 in. long, and .6 in. in diam., the apex crowned by the calyx and disc. Blume Mus. Bot. Lugd. Bat. I, 251; Miq. Fl. Ind. Bat. I, Pt. I, 787; Mast. in Hook. Fl. Br. Ind. I, 579; Kurz For. Flora Burmah, I, 235; Valetou, Olacines, 86.

Penang: Wallich. Malacca: Maingay. Perak: King's Collectors.

2. STROMBOSIA MULTIFLORA, King, n. sp. A glabrous tree 50 feet high and upwards; young branches slender, striate, minutely lenticellate, cinereous when dry. *Leaves* coriaceous, ovate to oblong-ovate, acute or shortly acuminate, slightly oblique, rounded at the base, the edges undulate; leaves 5 to 8 pairs, slightly curved, ascending, slightly prominent on the lower, obsolete on the upper, surface; length 2.5 to 4

in., breadth 1·5 to 2 in., petiole ·35 in. *Flowers* in dense axillary fascicles; pedicels shorter than the flowers, each with several rotund, concave, minute bracteoles, one of which is close to the calyx. *Calyx* a shallow cup with 5 broad rounded concave segments. *Petals* 3 in. long, much longer than the calyx, erect, oblong, obtuse, their apices re-curved, pubescent on the edges and in the upper fourth of the inner surface. *Stamens* opposite the petals to which their filaments are attached for two-thirds of their length; *anthers* short, ovate. *Ovary* sub-globular, grooved, much shorter than the long cylindric style, *stigma* minute. *Fruit* unknown.

Perak: King's Collector, No. 7824. Penang: Curtis, No. 859.

Evidently a *Strombosia*; the fruit, however, is as yet unknown. *

8. *STROMBOSIA ROTUNDIFOLIA*, King. A tree or shrub; young branches rather stout; their bark cinereous, rugose, much lenticellate. *Leaves* coriaceous, more or less rotund, glabrous; main nerves 6 or 7 pairs, rather straight, sub-ascending, obsolete on the upper, slightly prominent on the lower surface when dry; length 2·5 in., breadth 2 in.; petiole ·3 in., stout. *Fascicles* small, axillary, few-flowered, shorter than the petioles; pedicels short, each with 2 or 3 minute rotund scale-like bracteoles. *Calyx* cupular, with 5 broad rounded imbricate teeth. *Petals* 1·5 in. long, much longer than the calyx, oblong, hairy on the upper half inside, otherwise glabrous; *filaments* adnate to the petals for half their length, *anthers* ovate. *Ovary* sub-globular, *style* cylindric. *Fruit* (fide Masters) "the size of a pea, glaucous, globose." *Anacaloes Maingayi*, Mast. in Hook fil. Br. Ind. I, 580.

Singapore: Maingay (Kew Distrib.), No. 1019.

A species closely allied to *S. multiflora*, King, but with differently shaped leaves. The fascicles of this are fewer-flowered, and the flowers are smaller than in that species. I have seen only Maingay's specimen of this, and there is no fruit on it. Dr. Masters puts this plant into *Anacaloes*, but its petals and anthers are those of *Strombosia*, to which genus I venture to remove it.

6. *CANJERA*, Juss.

Climbing shrubs, sometimes spiny. *Leaves* alternate, entire, pinnately-nerved. *Flowers* bracteate, in short axillary spikes, monochlamydeous, hermaphrodite. *Perianth* tubular or urceolate, regular, 4-5-parted, lobes valvate. *Stamens* as many as the lobes of the perianth and opposite to them; filaments glabrous, free, or attached between the fleshy thick lobes of the disk. *Anthers* small, oblong, adnate, 2-celled, dehiscing longitudinally. *Ovary* superior, ovoid-conical, 1-celled. *Style* cylindric; *stigma* capitate, 4-lobed. *Ovule* solitary, erect, or pendulous.

from a short placenta. *Fruit* superior, drupaceous, surrounded at the base by the marcescent perianth; sarcocarp thin, endocarp bony. *Seed* solitary, erect, roundish; embryo in the upper part of the fleshy albumen, radicle superior; cotyledons sometimes 3, very long, plano-convex. *DISTRIB.* Species 3-4, natives of Tropical Asia and Australia.

CANSTREA RHEEDII, Gmel. Syst. I, 280. A climbing shrub; the young branches olivaceous, puberulous, sometimes spiny. *Leaves* thinly coriaceous, oblong-lanceolate to ovate, acute or acuminate, the base slightly narrowed, both surfaces glabrous; main nerves 3 to 5 pairs, curved, ascending, faint; length 2.5 to 4 in., breadth 1 to 1.5 in., petiole .15 in. *Spikes* 1 or 2 from an axil, .5 to 1 in. long, tomentose; bracteoles minute, linear-lanceolate, one at the base of each flower. *Flowers* .1 in. long, pubescent externally, apices of the teeth of the perianth re-curved. *Fruit* ovoid, .4 in. long, glabrous; embryo straight in the axis of copious albumen. Wall. Cat. 1043, B; Wight Ic. t. 1861; Bedd. Flor. Sylvat. Anal. Gen. t. xxvi.; Thwaites Enum. 251; Brandis For. Flor. 75; Hook. fil. Fl. Br. Ind. I, 582; Kurz For. Flora Burma I, 237; Valetton Olacineæ 158. *C. scandens*, Roxb. Cor. Pl. 103; Fl. Ind. i. 441. *C. malabarica*, Lamk. Dict. iii. 433. *C. sisypheifolia*, Griff. Notul. iv. 860, t. 537, f. 1. *C. martabanica*, Wall. Cat. 7266. *Olap P sumatrana*, Miq. Fl. Ind. Bat Suppl. i. 342. *Opilia amentacea*, Roxb. Fl. Ind. I, 86 Wall. Cat. No. 2331, *C. Rheede* Hort. Mal. vii. t. 2, 4. Wall. Cat. *Canscora*, No. 7537.

Andaman and Nicobar Islands: Malacca.—*DISTRIB.* British India, Malayan Archipelago.

I can find no trace of calyx in any of the flowers of this species which I have dissected, and I cannot find that the ovary has more than a single cell. The disc is deeply divided into 4 fleshy acute lobes, between which the stamens are inserted. The fruit is entirely superior. The genus is closely allied to *Champereia*, which has already been transferred by Messrs. Benthams and Hooker to *Santalaceæ*. It is also allied to *Lepionurus* and *Opilia*; and, with these, it should, in my opinion, be retransferred to the family *Santalaceæ* in which its founder, Jussieu, originally placed it. Wall. Cat. 7537 clearly falls here and not under *Lepionurus sylvestris*. Bl.

7. LEPIONURUS, Blume.

Shrubby. *Leaves* alternate, shortly petioled, simple, penninerved. *Inflorescence* axillary, spicate, with large deciduous bracts, the flowers solitary at the nodes, or in clusters of 3 or 4. *Flowers* monochlamydeous, regular, hermaphrodite. *Perianth* urceolate, the limb 4-parted; lobes valvate, glabrous within. *Stamens* equal in number to

the lobes of the perianth and opposite to them. *Anthere* glabrous. *Staminodes* 0. *Disk* fleshy, yellow, lining the perianth-tube. *Ovary* free, oblong-conical; *stigma* sessile, 4-lobed; *ovule* solitary. *Fruit* drupaceous, glabrous, endocarp crustaceous. *Seed* erect; embryo small, in the axis of fleshy albumen, radicle terete, cotyledons ternate.—*DISTRIB.* Species 2, natives of Tropical Asia.

LEPIONURUS STYLVESTRIS, Blume Bijdr. 1148. A glabrous shrub; the branches sub-atriate, pale when dry. *Leaves* membranous, oblong, elliptic-oblong or elliptic, shortly acuminate, the base cuneate; main nerves 7 to 9 pairs, rather straight, ascending; length 4 to 6.5 in., breadth 1.4 to 3.5 in., petiole .15 to .35 in. *Spikes* axillary, .5 to 1.25 in. long, solitary, or in clusters of 2 to 6, their rachises filiform, at first enveloped by the large ovate acute, membranous, deciduous bracts. *Flowers* long, the tube inflated and lined by the adherent disc; the lobes deltoid, spreading when mature. *Anthere* and filaments broad. *Fruit* ellipsoid to ovoid, .35 to .6 in. long when ripe. Blume Mus. Bot. Lugd. Bat. I, 246; Miq. Fl. Ind. Bat., Vol. I, Pt. I, 284; *Lepionurus oblongifolius*, Mast. in Hook. fil. Fl. Br. Ind. 583. Valetton, Olacines, 158. *Leptonium oblongifolium*, Griff. in Calc. Journ. IV, 236. *Opilia acuminata*, Wall. Cat. 7206, also Wall. Cat. 7464.

Malacca, Penang, Perak, rather common. *DISTRIB.*—British India, Burma, Malayan Archipelago.

I have not been able to make out, from dissections of dried specimens, the exact attachment of the ovule. But the ripe seed is unquestionably attached to the base of the cavity of the fruit. Whether the ovule was originally erect, or was attached in a pendulous manner, as some botanists assert, from the apex of a short central placenta, I am unable to say. The genus in my opinion is closely allied to *Canejera*.

8. CTENOLOPHON, Oliv.

Trees. *Leaves* opposite, petiolate, simple, penni-nerved. *Inflorescences* paniced-cymose. *Flowers* regular, hermaphrodite. *Ovary* 5-parted; lobes imbricate, not accrescent. *Petals* 5, free, imbricate, oblong, reflexed after flowering. *Stamens* 10, free, springing from a short, ring-like, hypogynous disk, those opposite the petals longer than the others; *anthere* roundish, apiculate, 2-celled, dehiscing lengthwise. *Staminodes* 0. *Ovary* free, shortly stalked, imperfectly 2-celled; *style* cylindric, bifid at the apex, stigmas capitate; *ovules* in pairs in each cell, collateral, pendulous. *Fruit* coriaceous or crustaceous, 1-celled, 1-seeded, dehiscing irregularly. *Seed* pendulous from the apex of a free central placenta, and provided with a dorsal pectinate crest.—*DISTRIB.* 2 known species, both Malayan.

1. Inflorescence pale-tomentose; flowers 2
to 25 in. long ... 1. *O. parvifolius*.

2. Inflorescence rusty-tomentose; flowers
4 in. long ... 2. *O. grandifolius*.

1. CTENOLOPHON PARVIFOLIUS, Oliver in Trans. Linn. Soc. XXVIII, 516, t. 43. A tree; young branches terete, purplish when fresh, cinereous when dry. Leaves opposite, coriaceous, elliptic or oblong-elliptic, entire, shortly and obtusely acuminate, the base cuneate or rounded; upper surface shining, the lower dull, both glabrous; main nerves about 10 pairs, faint, spreading, forming a double series of arches within the edge; length 2.5 to 4.5 in., breadth 1.25 to 2 in., petiole .3 to .5 in. Panicles terminal and axillary, shorter than the leaves, condensed, minutely cano-tomentose; bracts ovoid-deltoid, minute, deciduous; pedicels stout, about as long as the calyx. Flowers 2 to 25 in. long, oblong. Calyx-lobes sub-rotund, concave, minutely tomentose outside, sub-glabrous inside. Petals coriaceous, erect, oblong, concave, four times as long as the calyx, minutely pale tomentose on the back, the imbricate edges and inner surface glabrous. Anthers ovate, adnate, much shorter than the filaments. Ovary ovoid-globose, woolly, 2-celled, surrounded at the base by an annular disc: style long, cylindric, glabrous, 2-furrowed. Fruit ellipsoid, slightly obovoid, apiculate, striate, .6 to .75 in. long, minutely pale tomentose; the pericarp woody, splitting on one side when ripe. Seeds with an imperfect pectinate arillus. Masters in Hook. fl. Fl. Br. Ind. I, 579: Beccari, Malesia I, 120.

Malacca: Maingay (Kew Distrib.), No. 382. Perak: Soortechini, Wray, King's Collector.—DISTRIB. Borneo, Beccari, P. B., No. 2637, (fide Beccari). Sumatra: Forbes, 3002.

2. CTENOLOPHON GRANDIFOLIUS, Oliver in Trans. Linn. Soc. XXVIII, 517, t. 43, figs. 8 to 10. A tree; the young branches pale, sparsely lenticellate. Leaves oblong-elliptic, shortly acuminate, 3.5 to 5 in. long and 1.5 to 1.75 in. broad, otherwise as in *O. parvifolius*. Panicles terminal or axillary, almost as long as the leaves, more or less open and spreading, minutely rusty-tomentose; bracts scale-like, caducous; pedicels longer than the calyx. Flowers 4 in. long. Calyx and petals as in *O. parvifolius*, but rufous instead of pale-tomentose. Ovary as in *O. parvifolius*, but the ovarian cavity shorter. Fruit unknown. Masters in Hook. fl. Fl. Br. Ind. I, 577. Beccari, Malesia I, 120.

Malacca: Maingay (Kew Distrib.), No. 383.—DISTRIB. Borneo. P. B., No. 1966 (fide Beccari).

This species is much rarer than the last. In fact I have seen no other specimens than Maingay's. It closely resembles *O. parvifolius* Oliver., the only tangible differences that I can discover (in the absence

of fruit of this), being the greater size of its flowers, and the colour of the tomentum of the flowers and inflorescence which in this is rusty, whereas in *O. parvifolius* it is pale. Professor Oliver relies as a diagnostic mark on a difference in the length of the ovarian cavity; the cavity of the ovary in *O. parvifolius* reaching nearly to the base of the style, whereas in *O. grandifolius* it occupies the base only of the ovary.

9. XIMENIA, Linn.

A shrub or low tree. *Branches* spiny. *Leaves* shortly petioled, alternate, simple, 1-nerved. *Flowers* racemose, usually hermaphrodite. *Calyx* cupular, 4-5-toothed, persistent, not accrescent. *Petals* 4-5, oblong, revolute, hairy within. *Stamens* twice as many as the petals, hypogynous; *anthers* innate, linear, 2-celled. *Staminodes* 0. *Ovary* sessile, superior, 4-celled; *style* columnar, stigma simple; *ovules* solitary in each cell, pendulous, anatropous. *Drupe* ovoid, 1-celled; *stone* solitary.—*DISTRIB* Species, 4-5, 1 Mexican, 1 South African, 1 Bornean, 1 Polynesian, 1 widely dispersed through the Tropics of both hemispheres.

1 *XIMENIA AMERICANA*, Linn Sp Pl. 1193 Glabrous, the young shoots striate and lenticellate. *Leaves* coriaceous, oblong-ovate to sub-orbicular, the apex emarginate, the base rounded; length 1 to 2 in., breadth 75 to 1.25 in. *Racemes* short, axillary, or at the ends of short branches, few-flowered. *Flowers* hermaphrodite or polygamous, 35 in. long; the buds oblong, acute, bracts minute. *Calyx* much shorter than the petals. *Anthers* linear, erect, the connective thick. *Ovary* ovoid-conical, glabrous. *Style* as long as the stamens. *Stigma* simple. *Fruit* oval, glabrous, about 1 in. long, orange-red when ripe, the pericarp pulpy; *endocarp* bony, 1-celled, 1-seeded. Lamk. Illust. 297, fig. 1; DC. Prod. I, 533; Roxb. Fl. Ind. II, 252, W. and A. Prod. 89; Blume Mus. Bot. Lugd. Bat. I, 247; Miq. Fl. Ind. Bat. I, Pt. 1, 786; Hook. fil. Fl. Br. Ind. I, 574; Pierre For. Flor. Coch. China, x. 265; Kurz For. Fl. Burm. I, 233; Valetton Olacineæ, 74. *X. Russelliana*, Wall. Cat. 6784.

Malacca, Singapore, Nicobar and Andaman Islands:—*DISTRIB*, Malayan Archipelago; Peninsular India.

10. SCORODOCARPUS, Beccari.

A tall tree. *Leaves* alternate, simple, penni-nerved. *Flowers* dichlamydeous, in short axillary racemes. *Calyx* small, cupular, 4-crenate, not enlarging with the fruit. *Petals* 4 or 5, hypogynous, narrow, valvate, coherent by their edges until mature, lanate internally. *Stamens* twice as many as the petals, attached to them in pairs, dehiscing suturally, the filaments shorter than the linear elongate erect anthers.

Ovary ovoid, grooved, imperfectly 4- or 5-celled, with 4 or 5 elongated pendulous ovules. *Style* simple, much longer than the ovary; *stigma* minutely-lobed, terminal. *Fruit* globose, 1-celled, the epicarp thin, fleshy, the endocarp crustaceous. *Seed* solitary, globular, pendulous from the apex by a filiform thread (? placenta), embryo near the apex of the fleshy albumen, radicle superior. One species; native of Malaya.

1. *SCORODOCARPUS BORNEENSIS*, Beccari in Nuovo Giorn. Bot. Ital. IX, 273. A tall very foetid tree; branches dark-coloured, lenticellate. *Leaves* coriaceous, elliptic-oblong, acute, the base slightly cuneate or rounded; both surfaces glabrous, the reticulations transverse; main nerves about 5 pairs, curved, ascending, prominent beneath; length 5 to 6·5 in., breadth 2·5 to 3 in., petiole about ·75 in. *Racemes* under 2 in. long, puberulous, the flowers in clusters of 3 or 4. *Calyx* with wavy edge, nearly glabrous. *Buds* oblong; petals puberulous outside, ·3 to ·35 in. long. *Disc* 0. *Fruit* glabrous, 2 in. in diam. Valetton Olacineæ, 88. *Schmidelia foetidissima*, Wall. Cat. 8064. *Ximnia borneensis*, Baillon Adansonia LXI. 271 (in part).

Singapore: Wallich, Ridley, King. Johore: Ridley. Perak: King's Collector.—DISTRIB. Borneo.

Rather a common tree, every part of which has a foetid alliaceous odour. The wood is hard and durable, and is much prized for various purposes. This tree was collected by Wallich in Singapore, and he referred it to *Schmidelia*. The Wallichian specimens, however, were overlooked, and the plant was first described by Baillon from specimens collected by Signor Beccari in Borneo. Subsequently the latter Botanist founded for its reception, the genus *Scorodocarpus*. Its affinities are with *Ximnia*.

11. ANACOLOSA, Blume.

Shrubs or trees. *Leaves* alternate, petiolate, simple, penni-nerved. *Inflorescence* cymose, axillary. *Calyx* cup-shaped, 5-7-toothed, not accrescent. *Petals* 5-7, oblong, free, valvate, springing with the stamens from a hypogynous or perigynous disk. *Stamens* concealed in the cavity of the petals and slightly adnate to their bases, filaments glabrous, or pilose at the apex; *anthers* broad, innate, 2-celled, dehiscing longitudinally. *Ovary* imperfectly 2-3-celled below, 1-celled above; *style* cylindric, the stigma shortly lobed; *ovules* 2 or 3, pendulous, the placenta central. *Fruit* drupe-like, with the disc persistent at its apex and the slightly accrescent calyx at its base; *stone* crustaceous, 1- or imperfectly 2-celled, with a single pendulous seed; *embryo* minute at the apex of fleshy albumen, radicle superior.—DISTRIB. 5 or 6 species, British Indian and Malayan.

Calyx and pedicels glabrous ... 1. *A. Griffithii*.

Calyx and pedicels minutely rusty-pubescent

Leaves membranous; young branches

glabrous, dark-coloured; anthers with a

tuft of hairs in front ...

2. *A. puberula*.

Leaves coriaceous; young branches thick

with pale scurfy bark; anthers very

hairy ...

3. *A. heptandra*.

1. *ANACOLOSA GRIFFITHII*, Masters in Hook. fil. Fl. Br. Ind. I, 580.

A glabrous shrub or tree; young branches dark-coloured, glaucous. *Leaves* thickly membranous, ovate-lanceolate, sub-acute or acute, the base rounded or sub-cuneate; main nerves 5 or 6 pairs, obscure on both surfaces, curved, spreading; length 2.5 to 4 in., breadth 1.2 to 1.5 in., petiole .35 in. *Oxyces* axillary, few-flowered, sessile or very shortly pedunculate; pedicels longer than the flowers, angled, ebracteolate, glabrous. *Flower-buds* sub-globose. *Calyx* cupular, minutely 5- or 6-toothed, glabrous. *Petals* two or three times longer than the calyx, oblong, obtuse, the upper half thick and fleshy, the lower half concave, hairy towards its upper part, otherwise glabrous. *Stamens* embedded in the concavities of the petals, the filaments short, slender; the anthers sub-globular, hairy in front. *Ovary* conical, flocculent-hairy, tapering into the glabrous style, surrounded at the base by the annular fleshy disk. Kurz For. Flora Burma I, 236; Veleton Olacineæ, 92; Pierre For. Flor. Coch. Chine, t. 266 B.

Burma: doubtfully in the Andaman Islands.

I have seen no specimen of this from the Andamans, but I include it on the authority of the Flora of British India.

2. *ANACOLOSA PUBERULA*, Kurz in Jour. As. Soc. Bengal, 1872, Pt. 2, p. 297. A large shrub; young branches glabrous, dark-coloured, all parts except the inflorescence glabrous. *Leaves* membranous, oblong-lanceolate, the apex more or less acute, the base slightly narrowed; main nerves 3 to 5 pairs, distant, ascending, pale and prominent on the lower, faint on the upper surface; length 3.5 to 5.5 in., breadth 1.5 to 2 in., petiole .3 in. *Oxyces* few- or many-flowered, axillary, about as long as the petioles, their rachises conical, woody; pedicels ebracteolate. *Calyx* cupular, with 6 minute distant teeth, rusty-pubescent outside like the pedicels. *Petals* 6, in pairs, oblong, the upper half fleshy; the lower half concave, glabrescent externally, glabrous internally except for a tuft of long hairs at the apex of the concavity. *Stamens* opposite to and as many as the petals, hidden in their concavities; the filaments shorter than the anthers, broad, flat; *anthers* broadly ovoid, tufted, hairy; *disc* large, crenulate, surrounding the base of the conical style.

glabrous ovary; stigma small, minutely lobed. Fruit ovoid, glabrescent, .6 in. long, with the persistent disc at its apex and the slightly accrescent calyx at its base. Kurz For. Flora Burma I, 235: Valeton Olacineæ 93.

Nicobar Islands, Kurz.

Var. *Andamanica*. Leaves ovate-elliptic or ovate-lanceolate, main nerves 4 to 6 pairs, spreading, not pale underneath.

Andaman Islands: King's Collectors.

The specimens on which Kurz founded this species are in the Calcutta Herbarium. They were collected in the Nicobar Islands although Kurz, by a slip, attributes them to the Andamans. These Nicobar specimens are distinguished from all which have, since Kurz's time, been collected in the Andamans (where the plant is very common) by the smaller number of nerves in the leaves, which are, moreover, ascending and pale beneath, whereas these from the Andamans have more numerous nerves which are spreading and are not pale beneath.

3. *ANACOLOSA HEPTANDRA*, Maing. mss. ex Hook. Fl. Ind. I, 581. A shrub or tree; young branches stout, with pale scurfy bark. Leaves coriaceous, oblong-lanceolate, sub-acute at base and apex, glabrous; main nerves 5 or 6 pairs, ascending, obsolete on the upper, rather prominent on the lower surface; length 6 or 7 in., breadth 2.25 to 3 in., petiole .3 in. Flowers in crowded axillary cymes not much exceeding the petioles; pedicels short, rufous-pubescent like the calyx, ebracteolate. Ovary cupular, with 6 minute distant teeth. The other parts of the flower as in *A. puberula*, but the ovary narrower, and the anthers more hairy, not merely tufted with hairs. Valeton Olacineæ, 93.

Malacca; Maingay (Kew Distrib.), No. 368.

This species of which I have seen only two specimens (neither of which is in fruit) comes very near to *A. puberula*. The young branches however, are thicker, with paler bark, and have the anthers more hairy than in that species.

12. *PLATEA*, Blume.

Trees. Leaves entire, coriaceous. Male flowers in short axillary interrupted-glomerulose spikes; the females in shorter cymes. Flowers polygamo-dioecious. Sepals 5, distinct, imbricate, small. Petals 5, united below into a tube, the teeth valvate; in the female deciduous or absent. Stamens 5, alternate with the petals and inserted at their bases; the filaments short, anthers ovoid, 2-celled. Ovary in the female flower cylindric, oblong, obtuse, crowned by the large discoid stigma, 1-celled; the ovules 2, pendulous. Drupes baccate, the endocarp woody.

Seed pendulous, the embryo straight, in the axis of the copious albumen.—*DISTRIB.* about 4 species; all Malayan.

1. *PLATSA EXOELSA*, Blume Bijdr. 646. A tree 50 to 100 feet high; young branches slender, softly rusty-puberulous. *Leaves* thinly coriaceous, elliptic to oblong, acute or shortly acuminate, the base rounded or very slightly narrowed; upper surface sparsely rufous, puberulous at first, afterwards almost glabrous; lower minutely cinereous-lepidote; reticulations minute, rather distinct and puberulous on both surfaces; main nerves about 7 pairs, spreading, curved, puberulous; length 4·5 to 7 in., breadth 1·75 to 3·5 in., petiole 5 to 7 in. *Female flowers* in axillary, 7-or 8 flowered, shortly pedunculate, pubescent, axillary cymes 5 in long. *Sepals* 5 in, broadly ovate, acute, pubescent externally. *Petals* none or early deciduous. *Ovary* cylindric, puberulous; *ovule* (only 1 seen) pendulous, much elongate. *Fruit* narrowly ovoid-ellipsoid, tapering much to the apex, the base rounded 1 to 1·3 in. long, and 5 in. in diam; when ripe the pericarp yellowish, thin, glabrous, *endocarp* bony with a few short furrows, *seed* much attenuate at the upper end. Miq. Fl. Ind. Bat. I, pt. 1, 793. Beccari Malesia I, 116: Valetton Olacineæ, 253.

Perak: King's Collector, Wray. Penang: King's Collector, No. 1302. *DISTRIB.*—Java.

13. GOMPHANDRA, Wall.

Shrubs or trees. *Leaves* alternate, petioled, simple, penni-nerved, (rarely triple-nerved at the base). *Flowers* polygamo-dioecious, cymose, (practically unisexual). *Calyx* minute, cupular, 4-5-toothed. *Petals* 4 or 5, sometimes united and 4-or 5-lobed; often absent in the female flower. *Stamens* 4 or 5, hypogynous, alternate with the petals; *filaments* thick, flattened, hollowed in front, and attenuate at the apex; *anthers* rather small, pendulous from the apices of the filaments, 2-lobed, the dehiscence longitudinal. *Hypogynous disc* thick, annular, or absent. *Male flower* with rudimentary ovary sunk in the fleshy disc, the stigma minute. *Female flower* with long cylindric ovary and large discoid stigma, 1-celled (2-celled in two species), the ovules 2, collateral, pendulous from the apex, the funicle dilated. *Fruit* elongate, drupe-like, surmounted by the remains of the stigma; *pericarp* smooth, thin, *endocarp* leathery. *Seed* solitary, pendulous; *albumen* fleshy, bipartite; *embryo* minute.—*DISTRIB.* 8 or 10 species; Tropics of Asia. *Flowers* 4-merous.

Filaments with a large tuft of long white glandular hairs on both surfaces near the

apex 1. *G. comosa*.

Filaments with a few white hairs on the posterior surface.

- Cymes axillary or terminal ... 2. *G. lanceolata*,
Cymes extra-axillary or leaf-opposed ... 3. *G. penangiana*.

Flowers 5-merous.

Filaments hairy near the apex.

- Cymes on stout short peduncles, ovary hairy, fruit '8 in. long ... 4. *G. nysrifolia*.

Cymes on slender peduncles, ovary glabrous

- Pedicels of cymes less than half the length of the leaves; fruit '25 to '5 in. long ... 5. *G. Maingayi*.

- Pedicels of cymes half as long as the leaves; fruit '65 in. long, imperfectly 2-celled ... 6. *G. gracilis*.

- Filaments quite glabrous ... 7. *G. andamanica*.

1. *GOMPHANDRA COMOSA*, King, n. sp. A glabrous tree or shrub, young branches cinereous. *Leaves* thinly coriaceous, oblong to elliptic-oblong, shortly acuminate, much narrowed at the base; main nerves 6 to 8 pairs, sub-ascending, faint; length 3'5 to 6 in., breadth 1'5 to 2 in., petiole '35 to '6 in. *Cymes* on slender pedicels about as long as the petioles, umbellulate; cymules 3 to 5, each with 2 to 3 flowers. *Flowers* sessile, '2 in. long, the buds obovate-globose. *Calyx* shallow, the edge wavy and obscurely 4- or 5-toothed. *Petals* 4, four or five times longer than the calyx, broadly oblong, obtuse, with an inflexed sub-apical point, glabrous. Connective and upper part of filament densely covered with long, white, glandular-pointed hairs. *Ovary* short, ovoid, conic, immersed in the fleshy annular disk, *style* short. *Fruit* narrowly ellipsoid, glabrous, vertically grooved, 1 in. long, and '4 in. in diam., epicarp thin, endocarp cartilaginous, one-celled, 1-seeded.

S. Andaman; King's Collector's.—DISTRIB. Java.

The hairs on the filaments are white and very numerous, and they have conspicuous glandular apices. The ovary above described is that found in flowers bearing perfect anthers. It is probable that it aborts, and that fertile ovaries are confined to flowers (as yet undiscovered) in which the stamens are imperfect.

2. *GOMPHANDRA LANCEOLATA*, King. A shrub 5 or 6 feet high; young branches thin, puberulous. *Leaves* sub-coriaceous, lanceolate or oblong-lanceolate, sometimes very narrow, acuminate, the base cuneate; upper surface glabrous, the lower sparsely puberulous; main nerves about 5 pairs, spreading; the tips ascending, faint; length 2 to 8 in.,

breadth $\cdot 4$ to $1\cdot 5$ in., petiole $\cdot 15$ to $\cdot 3$ in. *Cymes* axillary and terminal, their pedicels several times as long as the petioles, usually 3, trichotomous; the cymes 3- to 10-flowered, pubescent or glabrescent. *Flowers* sessile, $\cdot 15$ in. long, buds clavate with truncate apices. *Calyx* cupular, with 3 or 4 small obscure teeth. *Petals and stamens of the male flowers and female flowers* as in *G. penangiana*. *Lasiandra lanceolata*, Mast. in Hook. fil. Fl. Br. Ind. I, 585. *Stemonurus tomentosa*, Valetton (not of Beccari) *Olacinae*, 237.

Malacca: on Mount Ophir, Griffith. Perak: King's Collector, Wray, Scortechini, common.

This is rather a variable species as regards the form of leaf and the amount of pubescence on the inflorescence, but the characters of the flowers are constant. For two of the best-marked of these forms I propose varietal names as below.

Var. *angustifolia*, King: leaves narrowly oblong-lanceolate, 2 to 6 in. long, and $\cdot 4$ to $\cdot 7$ in. broad: fruit ovoid with a long apiculus, also contracted at the base, 5 in. long. Wall. Cat. *Olacinae*, No. 7570.

Singapore, Wallich Penang, Curtis, Nos. 737 and 1265. Perak: Scortechini, King's Collector, No. 4211.

Var. *triplinervis*, the two lower lateral main nerves bold and continued nearly to the apex of the leaf.

Perak; Scortechini, No. 375.

3 GOMPHANDRA PENANGIANA, Wall. Cat. 7204. A glabrous or subglabrous shrub 3 to 8 feet high; young shoots thin, pale. *Leaves* shortly membranous, oblong, oblong-lanceolate or elliptic, shortly acuminate, the base cuneate; main nerves 5 to 9 pairs, spreading or ascending, slightly prominent; length $4\cdot 5$ to 7 in., breadth $1\cdot 5$ to $2\cdot 75$ in., petiole $\cdot 25$ to $\cdot 35$ in. *Cymes* extra-axillary or leaf-opposed, pubescent, trichotomous, spreading, many-flowered, their peduncles longer than the petioles, erect. *Flowers* $\cdot 15$ in. long, on short glabrous or pubescent pedicels. *Calyx* a shallow glabrous cup with 3 or 4 obscure broad teeth. *Corolla* in bud cylindric-clavate, the apex truncate, four or five times as long as the calyx, glabrous. *Petals* 4, oblanceolate (the apex inflexed), hyaline. *Filaments* flat, thick, tapering to each end, with a tuft of few long pale glandular hairs near the apex behind the insertion of the anther. *Rudimentary ovary* narrowly ovate, small, half-immersed in the deep fleshy lobed disk. *Cymes of female flowers* longer than the males, secund; *calyx* as in the male: *corolla* absent. *Ovary* elongate, cylindric, glabrous, crowned by a large discoid stigma wider than itself, one-celled with 2 elongated ovules pendulous from the apex. *Fruit* ovoid or elliptic, constricted at base and apex, vertically ridged, glabrous, crowned by the persistent stigma, $\cdot 5$ to $\cdot 7$ in. long. Masters

Hook. fl. Br. Ind. I, 587. *Stemonurus penangianus*, Miers Contrib. I, 90; Kurz For. Flor. Burm. I, 238. Wall. Cat. 3718. *G. acillaris* (in part).

Penang; Wallich, Curtis. Perak; Scortechini, King's Collector, Wray; very common.

4. *GOMPHANDRA NYSSIFOLIA*, King. A tree 15 to 40 feet high; young branches dark-coloured, slightly winged under the nodes. *Leaves* coriaceous, elliptic-ovate, abruptly and shortly acuminate, the base cuneate; main nerves rather straight, ascending, prominent on the lower surface, the transverse veins distinct, ovary sub-horizontal; length 3·5 to 5·5 in., breadth 2 to 2·5 in., petiole ·3 in. *Oymes* axillary, sometimes 2 together, their pedicels shorter than or as long as the petioles; flowers 4 to 6, sessile, ·25 in. long. *Female flower*: calyx cupular, with 5 minute distant teeth or sub-entire; *petals* 5, puberulous outside, 5 or 6 times as long as the calyx. *Filaments* flat, with a few white short hairs just below the anther, especially in front. *Disk* adherent to the base of the ovary, glabrous. *Ovary* cylindric, as long as the petals, puberulous, crowned by the large discoid lobed stigma. *Fruit* ellipsoid, slightly clavate, glabrous, ridged, crowned by the persistent stigma, ·8 in. long, and ·35 in. in diam.

Perak: Scortechini, King's Collector, Nos. 6406 and 6984.

I have not seen the true male flowers of this species.

5. *GOMPHANDRA MAINGAYI*, King. A glabrous shrub 4 to 6 feet high; young branches rather stout, dark-coloured, glabrous. *Leaves* sub-coriaceous, oblong-lanceolate and acuminate, or sub-rhomboidal acute, the base cuneate; main nerves 5 or 6 pairs, rather straight, ascending, prominent beneath; length 2 to 3·5 in., breadth ·9 to 1·2 in., petiole ·25 in. *Peduncles* longer than the petiole, slender; *cymules* 2 or 3, umbellulate, each 4- to 5-flowered. *Flowers* ·15 in. long, sessile. *Oalyx* cupular, tomentose, with 4 or 5 shallow teeth. *Petals* 5, four or five times as long as the calyx, rather thick, oblong, sub-acuminate, the apex inflexed, the midrib dark. *Filaments* pointed at the apex and with small tufts of long white sub-apical hairs; *anthers* pendulous from the apex of the filaments. *Eudimentary ovary* and disk absent. *Female flower* unknown. *Fruit* (*vide* Masters) ovoid, ·25 to ·5 in. long, 1-celled, 1-seeded. *Stemonurus Maingayi*, Valetou Olacines, 236. *Lasiianthera Maingayi*, Mast. in Hook. Fl. Br. Ind. I, 585.

Malacca: Maingay (Kew Distrib.), No. 3743. Penang: Curtis.

Known only by Maingay's and Curtis's scanty specimens. It is possible that under these there may really be two species: for Maingay's specimens divide themselves into two sets; one with sub-rhomboid acute leaves which bear the flowers described above; the other with narrowly

oblong-lanceolate leaves and which have neither flowers nor fruit. It is possible that the second set belong to an undescribed species.

6. *GOMPHANDRA GRACILIS*, King, n. sp. A glabrous shrub or small tree; young branches thin, pale. *Leaves* membranous, lanceolate or ovate-lanceolate, acuminate, the base much narrowed, the edges slightly recurved when dry, wavy and sub-crenulate; main nerves 6 or 7 pairs, spreading, faint. *Peduncles* axillary and terminal, nearly half as long as the leaves; the cymes trichotomous, compound, the ultimate cymules umbellate. *Male flowers* .1 in. long, the buds sub-globular; *Calyx* cupular, shallow, with 5 minute teeth; *petals* 5, oblong, glabrous, reflexed, 4 or 5 or 6 times as long as the calyx. *Filaments* 5, thin, flat, attenuate upwards, bearing a tuft of white bulbous-pointed hairs below the small anther. *Female flower* with calyx and abortive stamens like the male, the petals (if any) deciduous. *Ovary* long, cylindric, glabrous, crowned by the large pileate stigma, 2-celled, one of the cells usually empty, the other with a single long ovule suspended from its apex. *Fruit* ellipsoid, flat on one side, curved, glabrous, striate, about .65 in. long, imperfectly 2-celled and with a single pendulous seed.

Perak: Wray, King's Collector; common.

A species readily distinguished by its small flowers globular in bud, and by its curved imperfectly 2-celled fruit.

7 *GOMPHANDRA ANDAMANICA*, King. A tree; young branches tawny-puberulous. *Leaves* thinly coriaceous, oblong or elliptic, shortly and rather abruptly acuminate, the base round or narrowed, sometimes oblique; main nerves 8 or 9 pairs, curved, ascending, prominent beneath and depressed above when dry, length 5 to 8 in., breadth 2 to 3 in., petiole .4 to .6 in. *Cymes* in the axils of leaves or of fallen leaves, often 2 together, 5 to .8 in in diam., many-flowered, dense, rusty-pubescent, their peduncles stout and 4 or .5 in. long. *Flowers* nearly .15 in. long, sessile, globose-obovate in bud. *Calyx* cupular, thin, irregularly and minutely 4-5-toothed, tomentose externally, and glabrous internally like the petals. *Petals* 5, oblong-oblancoate, spreading, the apices curved, three times as long as the calyx. *MALE FLOWERS*: *stamens* 5, as long as the petals, free, the filaments quite glabrous; *anthers* hypogynous, fleshy, embracing the base of the narrowly ovoid small rudimentary ovary. *Female flower*: calyx as in the male; petals and stamens not seen; *ovary* narrowly ellipsoid, with a short constriction at the apex, stigma disciform. *Fruit* compressed-ellipsoid, about 1 in. long, slightly convex on one side, deeply grooved on the other; the pericarp glabrous, vertically striate, thin; the endocarp leathery, 2-celled, one cell without a seed, and divided by vertical false dissepiments into several chambers, the other cell occupied by a single pendulous flat seed.

bent vertically on itself at right angles. *Apodytes andamanica*, Kurz, Journ. As. Soc. Bengal, 1872, II, 296; Hook. fl. Fl. Br. Ind. I, 587.

Andaman and Nicobar Islands; Kurz. Narcondam Island; Prain.

This species was published as an *Apodytes* by Kurz. The stamens ovary and fruit however are exactly those of *Gomphandra*, to which genus I therefore transfer it. In *Apodytes* the stamens have long narrow anthers and short filaments, while the style is oblique and ex-centric, more or less curved, and the stigma small, the fruit being more or less orbicular or reniform with the scar of the stigma lateral.

14. LASIANTHERA, Pal. de Beauv.

Trees or shrubs, sometimes scandent. *Leaves* alternate, simple, penni-nerved, coriaceous. *Flowers* dichlamydeous, bisexual, in stalked axillary cymes. *Oalyx* minute, cupular, 4- or 5-lobed. *Petals* 5, free or rarely cohering, the apex inflexed. *Stamens* 5, hypogynous, free, alternate with the petals; the filaments flat, broad, the connective dilated behind and bearing a tuft of long hairs curving over the anther in the bud; *anthers* adnate, 2-lobed, dehiscing lengthwise. *Hypogynous disk* cup-shaped, more or less corrugated. *Ovary* ovoid, 1-celled, tapering into a subulate style, terminated by a minute stigma; *ovules* 2, pendulous. *Fruit* drupaceous; *stone* fibrous outside, woody within. *Seed* pendulous; *embryo* in albumen, cotyledons leafy and broad, radicle superior.—DISTRIB. Species 4, one African, the others Malayan.

The genus *Stemonurus*, as originally constituted by Blume in 1825, contained three species. One of these has been reformed by Messrs. Bentham and Hooker to the older genus *Lasiandra*, which was founded by Palisot-Beauvois in 1806; while the other two species of Blume, viz., *S. parviflorus* and *S. javanica*, have been placed in the genus *Gomphandra* Wall. as defined by Lindley (Nat. Syst. Ed. II, p. 439).

This arrangement is not, however, accepted by all botanists who have written concerning these genera. Miers (Contrib. I, 80) for example considers *Gomphandra* Wall. and *Stemonurus*, Bl. as identical, and both as undistinguishable from *Lasiandra*, Pal-Beauv.; while Baocari (Malesia I, pp 107, et seq.) keeps up all three genera, and in this, he is followed by Valetton (Olcines pp. 307, et seq.). M. Baillon, like Miers, includes the other two in *Lasiandra* which however he places in the natural family *Terebinthaceæ*. Dr. Masters (in Hooker's Flora of British India) follows Messrs. Hooker and Bentham, and I do so also. I have, however, modified the generic characters of *Lasiandra* and *Gomphandra*, and I have not followed Dr. Masters altogether in his allocation of the species. I find the best characters to distinguish *Gomphandra* from *Lasiandra* to be these:—*Lasiandra*, flowers truly hermaphrodite, stigma minute,—*Gomphandra* flowers practically unisexual, the stamiferous flowers having rudimentary ovaries and the seed-producing flowers having large cylindric ovaries with large discoid stigmas, and usually abortive stamens.

Ultimate branches of the inflorescence scor-
poid cymules 1·5 in. or more in length ... 1. *L. secundiflora*.

Ultimate branches of the inflorescence about
·25 in. long.

Leaves cuneate-obovate ... 2. *L. umbellata*.

Leaves elliptic-oblong or elliptic-acu-
minate ... 3. *L. malaccensis*.

1 *LASIANTHERA SECUNDIFLORA*, Miq. Fl. Ind. Bat. I, Pt. I, 799, Suppl. 342, t 2, pp 43 and 403 A glabrous tree 40 to 60 feet high; young branches stout, dark-coloured. *Leaves* coriaceous, elliptic or ovate-elliptic, very shortly and bluntly acuminate or obtuse, the base rounded or narrowed; the midrib prominent on the lower surface, depressed on the upper, main nerves about 10 pairs, ascending, curving slightly, not much more prominent when dry than the secondary nerves and wide reticulations; length 5 to 10 in., breadth 2·25 to 4 in.; petiole 5 to 7·5 in., stout. *Peduncles* solitary, longer than the petioles, woody, each bearing at its apex an umbel of 6- to 9-flowered second sub-scorpoid cymes. *Flowers* sessile, ebracteate, 25 in. long. *Ovary* short, puberulous. *Petals* glabrous, four or five times as long as the calyx, oblong, sub-acute, each bearing a fleshy conical inflexed process slightly below the apex. *Filaments* flattened, tapering to the base; the connective thick, bearing a dense tuft of white hairs as long as the stamen. *Ovary* furrowed, shorter than the stamens but longer than the style. *Fruit* narrowly ellipsoid, 2·5 in. long, and 1 in. in diam., tapering to each end, glabrous, vertically grooved, epicarp thin, mesocarp fibrous, endocarp thin and bony; embryo half as large as the albumen, cotyledons foliaceous, cordate, radicle superior. *Stemonurus secundiflorus*, Blume Bijdr. 649; Mus Bot Lugd. Bat. I, t XLV; Beccari, Malesia, Vol. I, t IV, figs. 16 and 17; Valetou, Olacinae 234.

Singapore, Johore. Ridley. Perak King's Collector, Wray.
DISTRIB.—Java, Sumatra.

2. *LASIANTHERA UMBELLATA*, King. A glabrous tree 50 to 60 feet high (or a shrub *vide* Beccari); young branches cinereous, terete. *Leaves* coriaceous, cuneate-obovate, the apex rounded or slightly retuse, much narrowed to the base, midrib prominent beneath; main nerves 7 to 9 pairs, ascending, faint; length 2·5 to 3·5 in., breadth 1·25 to 1·5 in., petiole ·5 to ·7 in. *Cymes* longer than the petioles, umbellulate, the 4 to 6 cymules each with 4 or 5 flowers. *Flowers* sessile, 1·5 in. long, broad, truncate. *Ovary* nearly half as long as the petals, pubescent, coriaceous, the edge with 5 broad rounded teeth. *Petals* same, coriaceous, elliptic, obtuse at each end and with an inflexed process below the apex, puberulous outside, glabrous inside. *Filaments* attenuated,

towards the base. Connective of anthers everywhere densely silky-comose, the anther lobes separated. Ovary globose-ovoid, tapering into the short style, 1-celled. Disk thin, hyaline, enveloping the base only of the ovary. Fruit unknown. *Stemonurus umbellatus*, Beccari, *Malesia*, I, 115; tav. XV, pp. 5, 6. *Stemonurus intermedius*, Scort. MSS. in Herb. Calc.

Perak: King's Collector, Scortechini.—DISTRIB. Borneo.

8. *LASIANTHERA MALACCENSIS*, Mast. in Hook fl. Fl. Br. Ind. I, 584. A glabrous tree 30 to 40 feet high; young branches cinereous, terete, glabrous. Leaves coriaceous, elliptic-oblong to elliptic, shortly and abruptly acuminate, the base narrowed, midrib prominent on the upper, depressed on the lower surface; main nerves about 10 pairs, straight, sub-ascending, faint on both surfaces; length 3 to 4.5 in., breadth 1.2 to 2.25 in., petiole .3 or .4 in. Cymes slightly longer than the petioles, dichotomous, 8- to 10-flowered. Flowers sessile, ebracteate, 2 in. long. Calyx with 5 acute teeth, puberulous. Petals 3 or 4 times as long as the calyx, otherwise as in *L. secundiflora*. Filaments with a small tuft of hairs in front, otherwise as in *L. secundiflora*. Fruit unknown. *Stemonurus capitatus*, Beccari, *Malesia*, I, 114, tav. XV, figs 7 to 11; Valetton, *Olaeines*, 236.

Malacca: Maingay (Kew Distrib.), No. 385. Penang: Curtis, Nos. 912, 957. Perak: King's Collector, Scortechini.

This species has smaller leaves and different cymes from *L. secundiflora*, but the flowers of the two are very much alike.

15. GONOCARYUM, Miq.

Trees. Leaves alternate, simple, penni-nerved, coriaceous. Flowers in long axillary spikes, dimorphous. Calyx of 5 free, ovate, imbricate sepals. Corolla much longer than the calyx, gamopetalous, tubular, with 5 acute spreading short teeth, slightly inflexed at the very apex, and valvate in aestivation. Stamens 5, alternate with the teeth of the corolla, the filaments adherent to its tube, free only towards the apex; anthers sub-exserted, alternate with the teeth, oblong, bilocular, dehiscing longitudinally. Ovary ellipsoid, seated on the glabrous annular disk, minute, bilocular, the cells (unequal?), uniovulate, the ovule pendulous. Style 1, very short, the stigma apical. Drupes dry, spongy, 4-gonous, ridged, narrowed to each end, crowned by the small incurved style and stigma; the calyx persistent at its base but not enlarged, 2-celled, the obsolete second cell being represented by a cylindrical cavity in the spongy mesocarp; the epicarp membranous, sub-glabrous in its upper half, puberulous towards the apex; endocarp papery, with a few minute

scattered hairs. Seed solitary, flattened, the abortive seed very small, both pendulous.

The genus *Gonocaryum* was first published by Miquel in his Fl. Ned. Ind. Suppl. p. 343, to receive the single species *G. gracile*. The generic description is incomplete as regards the structure of the seed, but the specimens with which the author worked have no seeds. I have had an opportunity of carefully examining these specimens and I find that Miquel's description is, as regards the structure of the ovary which is found in the stamiferous flowers, inaccurate. He describes two styles and stigmas, whereas, I can find only one of each. And to this extent, I have modified as above the generic description. I think it highly probable however, that fertile ovaries occur (as in so many members of this family) in distinct flowers, and that these may possibly have two stigmas like *Pteleocarpa* and *Cardiopteris*. Of such flowers however, there is no trace in the scanty materials on which Miquel founded the genus. There are two fruits however on one of the type specimens, and a transverse section of these shows a vertical cavity in the substance of the thick mesocarp on one side which has all the appearance of an aborted loculus. The single perfect seed which has filled the loculus, is too much decomposed for examination. In their *Genera Plantarum*, Messrs. Bentham and Hooker remark (in a note), that they have seen no specimen of *Gonocaryum* Miq. And without admitting it as a genus of *Olacineæ*, they quote Miquel's generic description. The late Mr. S. Kurz, in a note in Journ. As. Soc. Bengal for 1870, Pt. 2, p. 72, propounded the view that *Phlebocalymna* Griff. MSS., as described by Messrs. Bentham and Hooker (*Genera Plantarum* I, 353) is identical with *Gonocaryum*. Kurz, who had examined the specimens on which Miquel founded *Gonocaryum*, also believed Miquel to be wrong about the cells of the ovary; for he states that "the ovary is really one-celled and, to judge from the sterile fruits, 2-ovuled." The abortive seed in the fruit which Kurz examined was, he continues "suspended from the apex just beneath the acumen, and there can be observed also the rudiment of the second superposed ovule." But Kurz entirely overlooked the cylindrical cavity of the abortive loculus. Dr. Scheffer in (*Ann. Jard. Bot. Buitenzorg* I, 96), published a note on the genera *Gonocaryum* and *Phlebocalymna*, of neither of which had he seen (as he states) good or authentic specimens. In that paper Dr. Scheffer follows Kurz in reducing *Phlebocalymna* to *Gonocaryum*. Scheffer gives also a definition of *Gonocaryum* which differs a good deal from Miquel's. And he describes two new species of this modified *Gonocaryum* (viz., *G. Trymannianum* and *G. pyriforme*). I have examined the latter, and I do not find it to be a *Gonocaryum* at all, as Miquel defined the genus. Beccari (Malasia I,

122) follows Scheffer, adopts his modified definition of *Gonocaryum*, and adds two new species *vis.*, *G. Selebicum*, and (at p. 256), *G. affine*. In my opinion *Gonocaryum* and *Phlebocalymna* are not identical.

The flowers of the two species *P. Griffithiana* and *P. Lobbianum* (which are accepted as constituting the genus *Phlebocalymna*) have the calyx gamosepalous, deeply 5-lobed, the petals only twice as long as the calyx, fleshy, cohering by their edges, but quite separable from each other, their apices fleshy and inflexed; the buds being shortly cylindrical and obtuse, and the fruit elliptic (not 4-gonous), slightly striate, obtuse at each end with a bony (not spongy) and strictly 1-celled endocarp, and there being no trace whatever of an abortive loculus. If the definition of the genus *Phlebocalymna* be amended in these particulars to it certainly belongs *G. pyriforme*, Scheff. And, judging from the description, (for I have not seen specimens) *G. Teymannianum* Scheff. and *G. Selebi* Becc., with almost equal certainty belong to *Gonocaryum*. About the allocation of *G. affine*, Becc., the description in *Malesia* I, 256, is too incomplete to enable me to form an opinion.

Racemes 5 to 12 in. in length, flowers

·2 in. long. ... 1. *G. longe-racemosum*.

Racemes under 3 in. long; flowers ·1 in long 2. *G. gracile*.

1. *GONOCARYUM LONGE-RACEMOSUM*, King, n. sp. A small glabrous tree. *Leaves* coriaceous, elliptic-oblong, shortly acuminate, the base slightly narrowed; main nerves about 4 pairs, ascending, prominent on the lower, depressed on the upper surface, length 5 to 7 in., breadth 2·25 to 3·5 in., petiole ·3 to ·5 in. *Racemes* axillary or from the stem and larger branches, puberulous, slender, 5 to 12 in. long. *Flowers* ·2 in. long, irregularly disposed on the rachis, sometimes in pairs; their pedicels ·1 in. long, pubescent. *Sepals* 5, ovate, imbricate, puberulous. *Corolla* tubular, the teeth small and recurved. *Fruit* obovoid-elliptic, with 4 very bold vertical ridges and numerous striae, 1·5 to 2 in. long, and 1 in. in diam., glabrescent; *mesocarp* very thick, spongy, distinctly 2-celled, the aborted cell narrowly cylindric.

Singapore; Hullett, No. 851; Ridley, No. 4750. Perak; King's Collector, Nos. 7397, 7663; Soortechini.

2. *GONOCARYUM GRACILE*, Miq. Fl. Ind. Bat. Suppl. 343. A shrub? *Leaves* as in the last, but slightly obovate. *Racemes* under 3 in. in length, and the flowers only about ·1 in. long, fruit 1·5 in. long. Kurz in Journ. As. Soc. Beng. for 1875, II, 155; For. Flora Burma, I, 240. *G. Wallichii*, Mast. Fl. Br. Ind. I, 590; Beccari, *Malesia*, I, 122; Valsen Olacineæ, 245: *Platea Griffithiana*, Miers Contrib. I, 97, (not *Phlebocalymna*, Griff). *Gonocaryum?* *Wallichii*, Mast. in Hook. fl. Fl. Br. Ind. I, 590 (note).

Andamans or Tenasserim; *Halfar* (Kew Distrib.), No. 517, Distr. Sumatra; Lebong Moesia, Teymann.

I include this species here although it is not clear whether Halfar's specimen was collected in the Andamans or in the Tenasserim Province of Burmah. This differs from *G. longe-racemosa* by its shorter more slender racemes, and much smaller flowers. Other differences will no doubt be found when both plants are properly collected. At present the materials of *S. gracile* are very poor indeed. They are, however, sufficient to demonstrate that the plant so long known as *Phleboclymna Griffithii* does not belong to the same genus as the specimens on which Miquel founded his genus *Gonocaryum*.

16 PHYTOCENF, Wall

Climbing shrubs, usually more or less hairy, often prickly; wood with very large porous vessels and thick medullary rays, but no annual rings. *Leaves* alternate, petiolate, entire or palmately-lobed. *Flowers* dioecious, monochlamydeous, male in small globose clusters borne on long branching spikes, female in large solitary globose pedunculate heads. *Male flowers* each with an involucre of 3-5 free pieces, the perianth single, of 4 pieces, free, or united below and deeply 4-lobed, valvate. *Stamens* as many as the pieces of the perianth and alternate with them, the filaments hypogynous, *anthers* 2-celled, introrse, dehiscent longitudinally, *pollen grains* globose, the rudimentary pistil small. *Female flowers* without involucels, the perianth as in the males, more or less persistent in the fruit, *staminodes* minute, tooth-like, as many as the pieces of the perianth, or absent. *Pistil* sessile, 1-celled, villous; *style* thick, tapering, *stigma* large, sub-capitate or discoid, lobed or emarginate, *ovules* 2, collateral, suspended from near the apex of the cavity, raphe dorsal, *micropyle* superior. *Drupe*s many, in globose heads, bristly or echinate, *stone* hard, 1-celled, 1-seeded, pitted externally. *Seed* pendulous, *embryo* as long as the fleshy albumen, radicle superior, short; cotyledons large, flat, appressed.—DISTRIB. Species 8, all natives of India and the Malayan Archipelago.

There is a difference of opinion as to the nature of the organs at the base of the flowers, some authors regarding them as a calyx, while others (e g. Baillon) regard them as bracteoles. I adopt the latter view, chiefly because these bodies are not isomeric with the inner whorls of the perianth (corolla of some) or with the stamens. A further argument for considering them as bracteoles is found in the allied genus *Miquelia*, in the males of which similar organs are found, and where they are separated from the flower by a long pedicel.

Leaves entire	...	...	1. <i>P. oblonga</i> .
Leaves ovate, sometimes 3-lobed	...	...	2. <i>P. bracteata</i> .
Leaves deeply palmately 5-lobed	...	...	3. <i>P. palmata</i> .

1. *PHYTODIENUS OBLONGA*, Wall. Pl. As. Rar. III, 12. Bark brownish, rather rough, striate, not prickly, that of the younger branches puberulous. *Leaves* coriaceous, oblong or oblong-lanceolate, more or less acuminate, entire, the base narrowed; upper surface glabrous, shining, the lower minutely pubescent, minutely lepidote, the reticulations very distinct; main nerves 7 to 9 pairs, curved, ascending, prominent on the lower surface; length 4.5 to 9 in., breadth 2 to 3.5 in., petiole .6 to 1 in. *Panicles of male flowers* axillary, or clustered on woody warted tubercles on the stem and larger branches, 1 to 2 in. long, and from .4 to .5 in. broad, the ultimate branches consisting of minute pedicellate umbellules; the pedicels of the umbellules .15 in. long, rusty-tomentose, each with a subulate bract shorter than itself. *Flowers* sessile, .05 in. long, in 4- or 5-flowered umbellules .15 in. in diam. *Bracts of involucre* free, narrowly deltoid, rufous-sericeous. *Pieces of the perianth* 4, free, ovate, concave, glabrous inside, rufous-sericeous externally. *Stamens* shorter than the perianth, anthers broad. *Rudimentary ovary* minute, sericeous. *Female flowers* in shortly pedunculate globular capitula, .5 in. in diam., borne on the stem and branches, the peduncle stout, .25 in. long. *Drupe* obovate-ovoid, obtuse, 1.5 in. long, and 1 in. in diam.; the base pointed trigonous and strigose; the rest of the surface densely covered with very stout asperulous pale brown bristles, collected in globular heads, the size of a cricket-ball; epicarp leathery, mesocarp pulpy, endocarp crustaceous. *Seed* solitary; cotyledons thin, tortuous, embedded in lobulated fleshy albumen. Baill. in DC. Prod. XVII, 13; Hook. fl. Pl. Br. Ind. I, 592; Wall. Cat., No. 4948. *Gynoccephalum oblongum*, Trec. in Ann. Sc. Nat. Ser. 3, VIII, 149.

Penang; Wallich. Malacca; Maingay. Perak; Soortechni, King's Collector.

The female flowers are often diseased, and the petals are converted into a long fleshy tube which contains no trace of ovary.

2. *PHYTODIENUS BRACTEATA*, Wall. Pl. As. Rar. III, 12. Stems with sharp tubercles; branches striate, minutely prickly when young. *Leaves* coriaceous, broadly ovate, cordate at the base, often 3-lobed and obscurely dentate, the apex acute, upper surface glabrous, the nerves pubescent; lower surface pale, softly and minutely pubescent, reticulations distinct especially on the lower surface; main nerves 4 or 5 pairs, spreading, curved, prominent beneath; length 4 to 8 in., breadth 3 to 5.5 in.; petiole 1.25 to 3 in., minutely tomentose with bristles intermixed. *Panicles of male flowers* bracteate, axillary, 4 to

8 in. long, and from .75 to 1.25 in. broad; the ultimate branches consisting of minute clustered, 6- to 10-flowered, pedicellate umbellules; bracts from the bases of the pedicels of the umbellules, .4 or .5 in. long, subulate, curved, hispid. Flowers sessile, .05 in. in diam. Bracteoles of the involucre 3, deltoid, their apices broad and bifid, glabrous on the inner, densely villous on the outer surface. Fleshy of the perianth 4, free, ovate-lanceolate, acute, smaller than the sepals, valvate. Stamens shorter than the perianth, the anthers broad. Accessory ovary minute, villous. Female flowers (Ade Griffith) in oblong or spherical pedunculate capitula of which there are several in a leaf-axil. Style short, tri-partite; the segments revolute, stigmatiferous on the inner surface. Ovary strigose, 1-celled, with 2 pendulous ovules. Drupes ovoid, tapering to each end, densely covered with adpressed yellowish bristles, 1.5 in. long, and .75 in. in diam., 1-celled, crowded in dense pendulous globose capitula as large as a man's head. Seed solitary, albumen fleshy, radicle broad; cotyledons small, orbicular. Baill. in DC. Prod. XVII, 12; Hook. fil. Fl. Br. Ind. I, 592; Kurz For. Flora Burmah I, 242; Beccari Malesia, I, 127; Wall. Cat. No. 4947. *P. macrocarpa*, Griff. Notul. IV, 322. Ic. Pl. Ind. Or. 487 and 488. *Gynoecephalum bracteatum*, Trece in Ann. So. Nat. Ser. 3, VIII, 149, No. 3.

Penang; Porter, Curtis. Malacca; Griffith. Perak; King's Collectors. Singapore; Maingay, Ridley.—DISTRIB. Borneo.

3. *PHYTOCERE PALMATA*, Wall. Pl. As. Rar. III, 12. Stem minutely prickly; the younger branches rufous-hispid, striate. Leaves coriaceous, reniform, deeply 5-lobed; the lobes oblong, acuminate or acute; upper surface glabrous, the lower densely covered with soft coarse rufous or yellowish hairs; main nerves 5 to 7, palmate, prominent on the upper, depressed on the lower surface; length 7 to 12 in., breadth about the same; petioles 3 to 5 in., densely ferruginous-pilose. Panicles of male flowers axillary, 2.5 to 13 in. long, and about 1.5 in. broad, the ultimate branches consisting of minute 12- to 15-flowered, pedicelled, cymose umbellules; pedicels .15 in. long, softly pubescent. Male flowers as in *P. oblonga*. Female flowers in shortly pedunculate axillary ovoid capitula, .5 in. in diam.; the peduncle .25 in. long, pilose. Flowers .2 in. long, sessile. Bracteoles of the involucre of two deltoid bifid pieces: corolla 0. Ovary ovoid, pointed, densely hirsute. Drupes numerous, ellipsoid, slightly obovoid, tapering much to the base, the apex acute, the whole surface more or less densely covered with yellowish shining stiff hairs; 1.5 to 2 in. long, and .75 in. in diam., collected in sub-globose heads 3 or 4 in. in diam., Baill. in DC. Prod. XVII, 11; Miq. Ann. Mus. Lench. III, 248; Hook. fil. Fl. Br. Ind. I, 592; Beccari Malesia, I, 127. *Gynoecephalum palmatum*, Trece in Ann. So. Nat. Ser. 3, VIII, 149; Wall. Cat., 4949.

Penang; Wallich, Curtis. Malacca; Griffith. Perak; King's Collector, Wray.

17. MIQUELLIA, Meissner.

Climbing shrubs, the wood with large vessels. *Leaves* alternate, simple, entire or dentate, petiolate, penni-nerved. *Flowers* dioecious, the males pedicellate and in clustered umbels, the females sessile and in solitary capitula. *Male flowers* each on a long pedicel with a whorl of minute bracteoles at its base. *Perianth* 5-merous, the pieces oblong or lanceolate, free or united at the base, valvate. *Stamens* equal to the pieces of the perianth and alternate with them; filaments short, anthers linear-oblong, 2-celled, introrse, disk 0. *Rudimentary pistil* small. *Female flowers*;—bracteoles as in the male, sometimes united by their bases. *Flowers* sessile, the perianth deeply divided into 4 fleshy lanceolate reflexed segments. *Disk* none. *Ovary* solitary, compressed, crowned by the large discoid stigma, 1-celled, with 2 pendulous collateral ovules, raphe dorsal, radicle superior. *Drupe* oblong, more or less compressed, the calyx persistent at its base, the mesocarp thin; the endocarp crustaceous, rugose externally, often verrucose internally. *Seed* suspended, solitary, with thin testa, albumen fleshy rugulose, radicle superior; cotyledons elliptic, thick, leafy. Species about 5 Indian and Malayan.

1. MIQUELLIA CAUDATA, King, n. sp. A slender climber 10 to 20 feet long; branches thin, pale, striate. *Leaves* membranous, oblong-lanceolate, shortly acuminate, the base narrowed; upper surface glabrous, the lower puberulous especially on the midrib and 5 or 6 pairs of spreading, curving, ascending or spreading main nerves; length 5 to 8 in., breadth 1·5 to 2 in., petiole ·5 to ·65 in. *Umbels of male flowers* ·65 to 1 in. long, in fascicles from pilose tubercles on the stem, axillary or extra-axillary. *Bracteoles of involucrel of each flower* 4 or 5, free or united at the base, lanceolate, pilose. *Pedicels of flower* ·15 to ·2 in. long, pubescent. *Flowers* ·15 in. in diam., the segments of the perianth spreading, puberulous; *filaments* shorter than the linear-oblong sagittate anthers. *Rudimentary ovary* minute, hirsute. *Capitules of female flowers* ·25 in. long, ovoid, solitary, axillary; their peduncles 2 to 2·5 in. long, puberulous. *Flowers* sessile, ·15 in. in diam.; perianth leathery, glabrous. *Ovary* tomentose; the stigma discoid, depressed in the centre, wider than the ovary, glabrous. *Drupe* broadly ovoid, slightly compressed, rounded and broad at the base, tapering upwards into a long terminal tail crowned by the persistent stigma; epicarp thin, rusty-pubescent on the surface; endocarp bony, rough, and pitted on the outer surface, smooth and tubercled on the inner; length from base to apex 1 to 1·25 in., breadth at base ·6 in.

Perak; Scortechini, King's Collector.

This species is closely allied to *M. Kleinii*, which is a common plant in the forests at the base of the Assam Hill Ranges. This differs from *M. Kleinii* chiefly in its fruit having a long apical tail which is quite absent in the former. The male flowers also differ in the two species. The genus *Miquelia* was founded by Meissner (*Plant. Vase. Genera*); but Griffith, over-looking Meissner's description, published *M. Kleinii* under the name *Jenkinsia Assamica*, in 1844, in the Calcutta Journal of Natural History, Vol. 4. 231, t. 12. A description and figure of the female flowers are to be found in the same author's *Notulae*, 370; and a figure in his *Icones*, t. 537, fig. 2. Wallich issued the Assam plant as No. 6760 of his Catalogue under the name *Zanonia? oblonga*.

18. SARCOSTIGMA, W. and Arn.

Climbing shrubs. Wood without zones. Leaves alternate, simple, shortly petioled, much reticulate. Flowers dioecious, minute, arranged in glomeruli along a long pendulous rachis. MALE fl.: *Calyx* minute, cupular, 4-5 lobed. *Petals* 5, free, or nearly so, valvate, oblong, ultimately reflexed. *Stamens* 5, alternate with the petals, free, or adnate to the base of the petals, filaments glabrous; *anthers* ovate, sagittate, erect, 2-celled, dehiscing longitudinally. *Pistil* rudimentary. FEMALE fl.: *Calyx* and *corolla* as in the male, but shorter and more fleshy. *Staminodes* 4-5, hypogynous, alternate with the petals. *Ovary* superior, sessile, 1-celled; *stigma* sub-sessile, discoid or umbonate; *ovules* 2, collateral, pendulous, funicle thick. *Drupe* oblong, more or less compressed, surrounded at the base by the persistent calyx and corolla; *epicarp* coriaceous; *endocarp* woody, lined with a thin white membrane. *Seed* (according to Baillon) pendulous, exalbuminous; *cotyledons* fleshy, wrapping round the short superior radicle.—DISTRIB. Species 3 or 4, all tropical Asiatic.

SARCOSTIGMA WALLICHII, H. Brongn. in Adansonia, X, 282. A powerful climber; young branches pale, puberulous at first, afterwards glabrous like all the other parts except the inflorescence and fruit. *Leaves* coriaceous, shining, much reticulate, oblong to broadly ovate, acute, the base narrowed, under surface sometimes sparsely pubescent; main nerves 5 to 7 pairs, much curved, ascending; length 4 to 7 in., breadth 1.5 to 4.5 in., petiole .4 to .6 in. *Spikes of male flowers* axillary or extra-axillary, solitary or in fascicles, often nearly as long as the leaves, softly rufous-tomentose; *flowers* .1 to .15 in. long, sessile. *Calyx* a membranous, obscurely-toothed cup, rufous pubescent outside, glabrous inside. *Petals* about four times as long as the calyx, lanceolate, spreading, slightly united at the base, the apices inflexed, pubescent outside, gla-

brous inside. *Stamens* shorter than the petals, filaments glabrous. *Rudimentary ovary* ovoid, obtuse, pubescent. *Disk* none. *Female flowers* not seen. *Drupe* ovoid or globular-ovoid, compressed, 1.25 in. long and .75 in. in diam.; *pericarp* leathery, densely rusty-tomentose; *mesocarp* pulpy, rather copious; *endocarp* thinly bony, smooth on both surfaces. Baillon in DC. Prod. XVII, 16; Hook. fil. Fl. Br. Ind. I, 594; *S. edule*, Kurz, For. Flora Burmah I, 242. *Chailletia edulis*, Wall. Cat. 9030 ("indetermin.") Kurz in Andaman Report, App. 6.

S. Andaman; Kurz, King's Collector.—DISTRIB. Burmah.

Kurz himself (in Herb. Calcut.) reduced his species *S. edule* to *S. Wallichii* Baill., and there is no doubt the reduction is right.

19. *IONES*, Blume.

Climbing shrubs, rarely erect. *Leaves* opposite, or sub-alternate, petiolate, simple, penni-nerved. *Inflorescence* cymose, cymes axillary or extra-axillary; lower peduncles often sterile, cirrose. *Flowers* dichlamydeous, dioecious. *MALE fl.*: *Oalyx* minute, cup-shaped, 5-toothed. *Corolla* 5-merous, lobes valvate. *Stamens* hypogynous, equal in number to, and alternate with the lobes of the corolla; *anthers* basifixed, straight, 2-celled, introrse, dehiscing longitudinally. *Pistil* rudimentary. *FEMALE fl.*: *Oalyx* as in the male. *Corolla* 5-parted, the segments united below. *Staminodes* 0. *Ovary* sub-sessile, 1-celled, with 2 collateral pendulous ovules; *stigma* sessile, discoid. *Drupe* surrounded at the base by the persistent, but not accrescent calyx; *stone* 1-seeded. *Seed* pendulous, testa thin, albumen fleshy; *cotyledons* flat, leafy; *radicle* superior.—DISTRIB. Species about 8, natives of India, the Malayan Archipelago and tropical Africa.

Flowers 4-merous 1. *I. reticulata*.

Flowers 5-merous.

Calyx cupular with 5 minute teeth ... 2. *I. volutina*.

Calyx deeply divided into 5 lanceolate lobes.

Leaves ovate to rotund, pubescence ru-
fous 3. *I. ovalis*.

Leaves oblong or oblong-lanceolate;
pubescence cinereous 4. *I. oblonga*.

1. *IONES* RETICULATA, King, n. sp. A woody creeper 20 or 30 feet long; young branches slender, striate, with a broad line of tomentum on one side, changing sides at the nodes. *Leaves* thinly coriaceous, elliptic or broadly ovate, sometimes slightly obovate, shortly acuminate, narrowed slightly to the rounded or sub-emarginate base; both surfaces minutely but boldly reticulate, the upper glabrous, the lower with long soft hairs especially on the midrib and nerves; main nerves 4 or 5 pairs,

curving, ascending, prominent beneath as are the transverse nervules; length 2 to 5 in., breadth 1·3 to 2·5 in., petiole ·4 to ·6 in. *Gynae* both of male and female flowers terminal and extra-axillary, or occasionally axillary, usually much longer than the leaves, much-branched, and sometimes bearing tendrils, softly olivaceous-pubescent; pedicels longer than the flowers. *Male flowers* less than ·05 in. long, 4-merous, globular in bud. *Calyx* shorter than the corolla, with 4 acute segments, densely pilose outside. *Corolla* with 4 broadly ovate concave lobes, pilose outside and glabrous inside. *Stamens* shorter than the corolla, *anthers* broadly ovate, *rudimentary ovary* minute. *Female flowers* like the males but larger and with the lobes of the corolla reflexed. *Ovary* cylindric, tomentose, crowned by the broad discoid stigma, 1-celled, with 2 pendulous collateral ovules. *Drupe* elliptic, compressed, the apex with a slight apiculus bearing the stigma, the base narrowed; the calyx and corolla persistent but not enlarged, minutely velvety; *endocarp* bony, 4-angled, smooth inside. *Seed* solitary

Perak; Wray, King's Collector.

The tetramerous very small flowers, and large velvety fruit, distinguish this species. The young branches are sub-glabrous on one side and densely pubescent on the other; at the nodes these two lines cross.

2. *IONES VELUTINA*, King, n. sp. A scandent shrub; young branches slender, terete, shortly rufous-pubescent, especially so on one side. *Leaves* coriaceous, ovate, acute or very shortly acuminate; the base rounded, slightly emarginate; upper surface sparsely and minutely pilose, the midrib tomentose; lower surface densely velvety-tomentose; main nerves about 4 pairs, ascending, curved; length 2·5 to 3·75 in., breadth 1·35 to 2·25 in., petiole ·35 to ·6 in. *Gynae* axillary, terminal or leaf-opposed, longer than the leaves, pubescent, few-flowered, sometimes bearing tendrils. *Male flowers* ·1 in. long, or slightly more, globose-ovoid in bud, on very short pedicels. *Calyx* cupular, with 5 small acute teeth. *Corolla* little more than twice as long as the calyx, with 5 deep oblong concave teeth with inflexed apices, adpressed-pilose externally and glabrous internally like the calyx. *Stamens* nearly as long as the corolla; the filaments short, pilose, the anthers oblong. *Rudimentary ovary* ellipsoid, pilose. *Drupe* elongated-obovoid, compressed, 4-angled, obtuse or retuse at the apex, the stigma persistent, much narrowed to the base where the corolla and calyx are persistent, minutely cinereous-tomentose, 1·25 in. long, and ·5 in. broad; *endocarp* bony, more or less 8-angled, smooth inside. *Seed* solitary, compressed.

Malacca; Maingay (Kew Distrib.), No. 380, and perhaps No. 1030. Perak; Seortechini, Wray.

The leaves of this resemble those of *I. ovalis*, Bl.; but they are more velvety beneath. The calyx and fruit are much larger than in that species and the cymes have fewer flowers.

3. *IODES OVALIS*, Blume Bijdr. 30. A climbing shrub 20 to 60 feet long; young branches slender, rufous-tomentose, striate, with a few axillary or leaf-opposed tendrils. *Leaves* opposite, sub-coriaceous, ovate to rotund, acute or very shortly acuminate, the base rounded sometimes slightly emarginate; upper surface glaberrulous, the midrib and nerves rufous-tomentose like the whole of the lower surface; main nerves 4 or 5 pairs, curved, ascending, prominent on the lower surface as are the transverse veins; length 2.5 to 5.5 in., breadth 1.75 to 3.25 in. *Male flowers* in leaf-opposed or terminal, much-branched, lax, rufous-tomentose cymes 6 to 8 in. long. *Flowers* .15 in. in diam., on pubescent pedicels .1 to .2 in. long. *Calyx* discoid, irregularly 3- to 6-toothed rufous-villose. *Corolla* 5 or 6 times as long as the calyx, deeply divided into 5 lanceolate lobes with long acuminate inflexed points, strigose externally, glabrous internally; *stamens* much shorter than the corolla-lobes, the filaments much shorter than the broadly ovate anthers; *rudimentary pistil* erect, cylindric, pilose. *Female flowers* with calyx and corolla like the male; *stamens* 0. *Ovary* cylindric, tomentose, crowned by a large discoid stigma wider than itself, 1-celled, with 2 pendulous ovules. *Drupe* ovoid, compressed, slightly oblique at the base, rufous-tomentose, crowned by the persistent stigma, .75 in. long, and .5 in. in diam., *pericarp* thin; *endocarp* bony, rugose outside, smooth inside. *Mast.* in Hook. fil. Fl. Br. Ind. I, 596; Beccari Malesia, I, 124; Baill. in DC. Prod. XVII, 22; *I. tomentella* cumvar. Br. in Benn. Pl. Jav. Rar. 243, t. 48; Hassk. Cat. Pl. Hort. Bogor. 172; Miq. Fl. Ind. Bat. i. 795. *I. tomentella*, Miq. Fl. Ind. Bat. I, Pt. 1, 796; Kurz For. Flora Burmah I, 243. *Natsatium oppositifolium*, Planch. in Hook. Lond. Journ. Bot. V, 247.

Malacca; Griffith, Maingay. Perak; Scortechini, Curtis, King's Collector; common.—*DISTRIB.*—Burmah, Sumatra.

4. *IODES OBLONGA*, Planch. in Hook. fil. Fl. Br. Ind. I, 597. A slender climbing shrub; young branches cinereous-tomentose, ultimately glabrescent and rugose. *Leaves* membranous, oblong or oblong-lanceolate, glabrous above except the pilose midrib and nerves, beneath adpressed-pilose, the midrib pubescent; main nerves 7 or 8 pairs, curving, spreading; length 3 to 4.5 in., breadth 1 to 1.6 in., petiole .3 or .4 in. *Cymes of male flowers* axillary or terminal, dichotomously branched, slender, cinereous-pilose. *Male flowers* .05 in. long. *Calyx* nearly as long as the corolla, with 5 deep lanceolate lobes. *Corolla* rufous-tomentose externally. *Female flowers* and drupes not seen,

Penang; Phillips, Curtis, No. 2438. Singapore; King's Collector, No. 1185.

This species has smaller flowers, with a longer calyx, than the last: its leaves are narrower, and its pubescence is cinereous not rufescent.

20. *ERYTHROPALUM*, Blume.

Climbing glabrous shrubs with axillary tendrils. *Leaves* alternate, entire, 3- to 5-nerved at the base. *Cymes* slender, pedunculate, dichotomous; the cymes umbellate, minutely bracteolate. *Flowers* bisexual. *Calyx* with 5 broad short teeth, imbricate in aestivation, its tube adherent and much enlarged in fruit. *Corolla* perigynous; *petals* 5, short, broad, spreading, slightly coherent by their bases, inserted outside the large cupular fleshy 5-lobed disc, valvate in aestivation. *Stamens* as many as the petals, opposite to them and slightly attached to their bases, *filaments* short; *anthers* broadly ovate with lateral longitudinal dehiscence, the connective rather large. *Ovary* half immersed in the disc, tapering to a short terminal style, 1-celled; *ovules* 1 to 3, pendulous from the apex; *stigma* minute, 3-lobed. *Fruit* crowned by the persistent calyx-lobes and the disc, oblong, 1-celled; the pericarp and putamen thin, lined by a pulpy coat, splitting, when dry, into 3 to 5 vertical segments. *Seed* solitary, pendulous; the embryo minute, lying near the apex of the large fleshy albumen.

To this genus there are attributed in the Flora of British India three species, viz., *E. scandens*, Bl. *E. populifolium*, and *E. vagum*, Mast. Each of the three originally appeared in Botanical literature as the type of a distinct genus. Of these three genera, *Erythropalum* is the oldest and is therefore now retained. It was founded by Blume (Bijdr. 921) in 1826, and was by him referred to the Natural order *Cucurbitaceae*. As Blume describes the flowers as monœcious, his material was presumably imperfect. For the reception of the second species, Dr. Walker-Arnott, in Jardine's Magazine of Zool. and Bot. for 1838, p. 551, formed the genus *Mackaya*, and in an excellent note he discusses its affinities. Of it he says, "I cannot indicate the natural order, nor even the place in the linear series which it ought to occupy;" but on the whole he was inclined to regard it as a species of *Olacineæ* near *Schœpfia*, but with perfectly inferior fruit. Walker-Arnott considered it to be also allied to *Santalaceæ*, although differing both from that Order and from *Olacineæ* in the absence of a central columella in its ovary; while, from *Santalaceæ*, it has the additional difference of possessing a corolla. And he suggests the formation of *Mackaya* and *Schœpfia* into a small calycifloral order connected on the one hand with *Santalaceæ* and on the other with *Olacineæ*. The third species *E. vagum* Mast., was first published by Griffith (Notulæ IV, 638 and Ic. Pl. Ind. Or. t. 636) as the type of a genus which, from its supposed affinity with *Modecca*, he named *Modeccopsis*. The relation to *Modecca* is however superficial, and extends only to a similarity in general habit and in the externals of the fruit. For in structure the flowers of *Modecca* are very different from those of *Modeccopsis*, inasmuch as they have no perigynous (finally epigynous) disc, and the superior ovary

has 3 pericarpal multi-ovulate placentas, while the fruit is a 2-valved many-seeded capsule. Planchon [Ann. des Sc. Nat. Ser. IV. Bot., Vol. II, p. 260 (1854,)] suggests the formation of a natural order for the reception of the single species *Erythropalum*, a suggestion followed by Miquel; while Baillon puts it (along with *Olacineæ Santalacæ*, *Ampelidæ*, *Stryacæ*, and *Loranthæ* proper) into his order *Loranthacées*. Messrs. Hooker and Bentham put *Erythropalum* into *Olacineæ*, where, in spite of its affinities with the Cornaceous genus *Nyssa*, it may be left for the present, although its inferior fruit makes its inclusion in *Olacineæ* rather an anomaly. To this genus also without doubt belong *Decastrophia*, Griffith (Notulæ IV, 787); *Erythropalla*, Hassk. Cat. Hort. Bogor, 191; and in all probability (as Valenton suggests) the obscure plant named *Balingayum decumbens* by Blanco (Fl. de Filip. 187.)

1. *ERYTHROPALUM SCANDENS*, Blume Bijdr. 921. *Leaves* membranous, ovate-oblong or elliptic to oblong-lanceolate, acuminate, the base rounded or minutely cordate, sub-peltate; basal nerves 3 to 5, two of them minute; lateral nerves about 4 pairs, distant, faint; length 8 to 6 in., breadth 1·75 to 3·75 in., petiole ·75 to 1·75 in. *Tendrils* (abortive peduncles) simple or bifid, thickened upwards. *Oymes* slender, shorter than the leaves, divaricate, the peduncles long. *Flowers* under ·1 in. in diam. *Fruit* oblong, ellipsoid or slightly obovoid, glabrous, the epicarp yellowish. *Seed* large, ovoid, without testa. Miq. Fl. Ind. Bat. I, Pt. 1, 704; Hook. fil. Fl. Br. Ind. I, 578; Pierre For. Flor. Coch. Chine, t. 269 A; Kurz For. Flora Burma, I, 234; Valetton *Olacineæ* 132; Wall. Cat. 7539 *Menispermæ*?; also No. 9033 (without name). *Cocculus calophyllus*, Wall. MSS.

Malacca, Perak:—DISTRIB. Java, Burmah, Tropical Himalaya, Khasia Hills.

Closely allied to, if not identical with, this is *E. vagum*, Mast. And *E. populifolium* Mast. (Wall. Cat. Nos. 1233 bis. and 2248; *Passiflora Hayneana*, Wall.)

21. *PTELEOCARPA*, Oliv.

Trees. *Leaves* alternate, simple, penni-nerved, petiolate. *Inflorescence* terminal, panicle, many-flowered. *Flowers* regular, dichlamydeous, hermaphrodite. *Calyx* tubular below, limb deeply 5-parted, lobes imbricate, not accrescent. *Corolla* tubular below-limb deeply 5-parted, lobes imbricate, glabrous. *Stamens* 5, glabrous, attached to the tube of the corolla, alternate with its lobes; *anthers* linear-oblong, innate, dehiscing longitudinally. *Ovary* free, stipitate, 2-celled; *styles* 2, *stigmas* small; *ovules* solitary in each cell, pendulous, anatropal, raphe lateral or subventral. *Fruit* 2-celled, samaroid, orbicular, emarginate; the wings broad, thin, striate. *Seed* elongate, much compressed, albuminous; *radicle* superior, cylindrical; cotyledons linear-lanceolate, longer than the radicle.—DISTRIB. Species 2, both Malayan.

PTHELBOCARPA MALACCENSIS, Oliver in Trans. Linn. Soc. XXVIII, 515, t. 42. A tree; young branches terete, glabrous, slender; all parts except the puberulous inflorescence glabrous. *Leaves* membranous, oblanceolate or oblanceolate-oblong, shortly and bluntly acuminate, the base much narrowed; midrib prominent beneath, the 5 or 6 pairs of curving spreading main nerves obscure on both surfaces; length 3 to 4½ in., breadth 1·25 to 1·5 in., petiole ·6 to ·75 in. *Panicles* terminal, umbellately cymose, spreading, many-flowered, 1·5 to 2·5 in. in diam.; bracts minute, deciduous. *Pedicels* ·15 to ·25 in. long, filiform, ascending, lengthening in fruit. *Flowers* yellow, (or red?) ·3 in., in diam. *Calyx-lobes* broadly ovate, obtuse, puberulous. *Corolla* four times as long as the calyx, its tube short, the lobes deep, oblong, obtuse. *Stamens* as long as the corolla; the filaments slender, glabrous, the anthers elliptic. *Ovary* on a short thick stalk, oblong, glabrous, compressed, slightly furrowed, obtuse. *Fruit* 1·25 to 1·65 in. long, the calyx persistent at the base not quite so broad. *Seed* ·5 in. long: embryo much shorter than the albumen. Beccari, Malesia, I, 130; Miq. Fl. Ind. Bat. Suppl. 511.

Malacca; Maingay. Penang; Curtis, Nos. 835 and 1494. Perak; Wray, No. 3418. Singapore; Hullett, Nos. 3609 and 3610.

I have seen an authentic specimen of *Dodonaea Lamponga*, Miq. (Fl. Ind. Bat. Suppl. 511) and there can be no doubt that it belongs to this or to a closely allied species. It was collected by Teysmann in Eastern Sumatra. Beccari has described (Malesia, I, 130) a species (*P. longistyla*) from Borneo, which appears to differ from *P. malaccensis* by the length of its styles and the shortness of the filaments of its stamens.

22. CARDIOPTERIS, Wall.

Herbaceous, scandent, glabrous, the juice milky. *Leaves* alternate, long-petiolate, simple, palminerved. *Flowers* small, hermaphrodite, regular, in axillary long sparse few-branched panicles. *Calyx* 5-partite, the lobes imbricate, persistent in the fruit, but very slightly accrescent. *Corolla* very deciduous, sub-campanulate, deeply 5-lobed, imbricate. *Stamens* attached to the short tube of the corolla and alternate with its lobes; filaments short, glabrous; anthers 2-celled, introrse, with vertical dehiscence. *Disk* none. *Pistil* free, cylindrical, slightly compressed, 1-celled; crowned by two stigmas, the one stipitate short and capitate, the other elongating after flowering. *Ovules* 2 (1 usually aborted), pendulous from the apex of the ovary. *Fruit* samaroid, obovate, oblong, emarginate at the apex; the nucleus narrow, elongate, prolonged laterally into membranous, horizontally striate wings and crowned by the columnar accrescent stigma. *Seed* solitary, pendulous, linear, sulcate, with thin testa,

fleshy granular albumen, and small conical embryo.—**DISTRIB.** A single Malayan species.

CARDIOPTERIS LOBATA, Wall. Cat. 8033 A, and in Benn. Pl. Jav. Rar. 246, t. 49. *Stems* twining, terete, striate, pale when dry. *Leaves* membranous, ovate-cordate, acuminate, more or less lobed, glabrous; main nerves 7 to 9, radiating from the apex of the petiole; length 2·25 to 5 in., breadth 1·5 to 2·75 in., petiole 2 to 5 in. long. *Panicles* 2 to 4 in. long, solitary, axillary, on long peduncles with a few long slender recurved few-flowered branches. *Flowers* distant, 1 in. long, on short puberulous pedicels. *Calyx* puberulous; corolla slightly longer than the calyx, pale. *Anthers* emarginate. *Fruit* .8 to 1·25 in. long, by .6 to .8 in. broad, the calyx persistent and very slightly accrescent. *Seed* sub-cylindric, compressed. Miq. Fl. Ind. Bat. I, Pt. 1, 799. H. Brongn. in Adansonia, X, 280: Baillon in DC. Prod. XVII, 26. *C. moluccana*, Blume, Rumphia, IV, 207, t. 177, f. 2. *C. javanica*, Blume l. c. III, 206, IV, t. 177. *Peripterygium quinquelobum*, Hassk. Cat. Pl. Hort. Bogor. 351. *Olus sanguinis*, Rumph. Herb. Amb. V, t. 482.

Perak: King's Collector.—**DISTRIB.** British India, Siam, Malayan Archipelago, New Guinea

A widely distributed plant, varying considerably as to the form of its leaves. On these diversities of shape, four varieties have been founded.

The position of *Cardiopteris* has given rise to considerable discussion. Robert Brown was the first to suggest its affinity to *Phytocrene* and *Iodes*. By Wallich (its original founder) the genus was placed in *Sapindaceæ*; Hasskarl placed it in *Euphorbiaceæ*; and Blume regarded it as forming a separate family near *Boraginææ* and *Verbenacææ*. There is no doubt that the gamopetalous character of the corolla and the absence of a disk are characters at variance with those of the majority of the species which are grouped in the family of *Oleaceææ*; but the ovulation and structure of the fruit of *Cardiopteris* are quite unlike those of either of the gamopetalous families suggested as allies by Blume. The single character which, in my opinion, suggests a relationship with *Euphorbiaceææ* is the milky nature of the juice. The stamens and ovary, as Brown pointed out, are essentially those of *Iodes*, from which genus however this differs in calyx and in fruit. The genus with which, as it appears to me, there is by far the closest relationship is *Pteleocarpa*, Oliver. In fact the only characters which separate *Pteleocarpa* from *Cardiopteris* are that *Pteleocarpa* is a tree, while *Cardiopteris* is a scandent milky-juiced herb; and that *Pteleocarpa* has a 2-celled ovary and 2-celled fruit. And even this latter distinction is to a great extent neutralised by

the facts that, although there are two cells in the ovary of *Pteleocarpa*, there is only 1 ovule in each; and that both genera have two stigmas which are to some extent persistent in the fruit. The fruits of the two are strikingly alike, both being samaroid; and in this respect differing from all the other Asiatic genera which it has ever been proposed to include in *Olacineæ*. So great are the affinities of the two genera with each other, and so great their divergence from the other genera in the order, that I think they ought either to be separated as a tribe of *Olacineæ* or that the Natural family *Cardiopteridaceæ* first suggested by Blume, partially approved of by R. Brown, and adopted by Baillon, should be kept up, and that *Pteleocarpa* should be added to it.

ORDER XXX.—ILICINEÆ.

Shrubs or trees. *Leaves* alternate, simple, exstipulate, or with 2 minute stipules, usually coriaceous and evergreen. *Flowers* small, in axillary cymes fascicles or umbellules, usually dioecious, ♂ with imperfect ovary, and ♀ with imperfect stamens. *Calyx* 3-6-partite or -lobed; segments or lobes imbricate, persistent. *Petal's* 4-5, rarely 6-8, connate at the base, or connate in the ♂ and free in the ♀, deciduous, imbricate. *Stamens* 4-5, adhering to the bases of the petals, sometimes free and hypogynous in the ♀. *filaments* subulate; *anthers* shortly oblong, dorsifixed. *Disk* 0. *Ovary* free, 3-16-celled; *style* 0, or very short, rarely long, stigma capitate or discoid; *ovules* 1, or 2 collateral, pendulous, raphe dorsal, micropyle superior, funicle often cupular. *Drupe* with 2 or more 1-seeded, free, rarely connate stones. *Seed* with a membranous testa, fleshy albumen and minute embryo.—**DISTRIB.** Three genera, and about 220 species, chiefly tropical.

1. ILEX, Linn.

Calyx 4-5-lobed or -parted. *Corolla* with petals free or connate at the base and rotate. *Stamens* 4-5, adhering to the base of the corolla in the ♂, sometimes hypogynous in the ♀. *Ovary* 2-12-celled; *styles* 0 or very short, stigmas free or confluent on the top of the ovary. *Drupe* globose, very rarely ovoid, with 2-16 stones.—**DISTRIB.** Of the Order; species about 220.

Flowers of both sexes in simple axillary

racemes 1. *I. spicata*.

Flowers in axillary fascicles.

Pyrenes 6 or 7

Leaves very obtuse, entire ... 2. *I. epiphytica*.

Pyrenes 4

Leaves acute, serrulate ... 3. *I. Griffithii*.

- Leaves shortly acuminate, entire ... 4. *I. glomerata*.
 Flowers of both sexes in branched pedunculate
 cymes.
 Pyrenes 4 to 6; nerves of leaves 10 to 12
 pairs ... 5. *I. Maingayi*.
 Pyrenes 8
 Cymes dense, capituliform; nerves of
 leaves 7 or 8 pairs ... 6. *I. macrophylla*.
 Cymes branched, often paniculate, rather
 lax; nerves of leaves 6 to 8 pairs ... 7. *I. cymosa*.
 Imperfectly known ... 8. *I. sclerophylla*.

1. *ILEX SPICATA*, Bl. Bijdr. 1149. A glabrous shrub (sometimes epiphytal, *fide* Blume); young branches rather stout, pale, glabrous. *Leaves* coriaceous, elliptic, shortly and abruptly caudate-acuminate, the base rounded or slightly cuneate; the midrib stout, prominent beneath, depressed above; main nerves 7 to 12 pairs, faint, spreading (not much more prominent than the secondary) straight, interarching within the edge; length 3·5 to 6 in., breadth 1·5 to 2 in., petiole ·2 in. *Racemes* solitary or in pairs, axillary, ·75 to 1·5 in. long, sub-erect or spreading, puberulous, the bracts minute, pedicels 1 in. long. *Flowers* shorter than the pedicels. *Calyx* rather flat, with 4 or 5 broad rounded lobes. *Petals* broadly oblong, united at the base, finally reflexed. *Stamens* as many as the petals, inserted at their edges near the base; *filaments* longer than the corolla, *anthers* small. *Female flowers* like the male, but the petals and stamens smaller. *Ovary* broadly ovoid, compressed, 16-celled; the stigma large, sessile, elongate. *Drupe* ·15 in. long, broadly ovoid, compressed, the stigma persistent; *pyrenes* 10 to 16, compressed. Hook. fil. Fl. Br. Ind. I, 598. *Prinos spicata*, Miq. Fl. Ind. Bat., I, Pt. 2, 594.

Malacca: Maingay (Kew Distrib.), No. 390. Perak: King's Collector, No. 2463.—DISTRIB. Java, (?) Borneo, Sumatra.

A species readily distinguished by its compressed fruit which has moreover many pyrenes (from 10 to 16).

2. *Ilex epiphytica*, King, n. sp. A small glabrous epiphytic shrub; young branches rather stout, pale brown, striate. *Leaves* coriaceous, oval or elliptic, sometimes sub-obovate, very obtuse, the edges entire recurved when dry, the base slightly narrowed; main nerves 5 or 6 pairs, rather straight, spreading, not prominent; length 2 to 2·75 in., breadth 1 to 1·35 in., petiole ·15 in., stout. *Female flowers* in axillary fascicles of 5 to 7, ·15 in. in diam., their pedicels ·15 in. long. *Calyx* with 5 to 7 broadly ovate concave obtuse imbricate teeth, puberulous at the edges. *Petals* 6, oblong, sub-obtuse, longer than the calyx, free, nearly equal, imbricate. *Ovary* broadly ovoid, tapering to the very short style,

6- or 7-celled; *stigma* discoid, dotted in the middle. *Drupe* ovoid, .2 to .25 in. long, crowned by the persistent style and stigma; *pyrenes* 6 or 7, trigonous. *Male flowers* not known.

Perak; at elevations of about 5,000 feet, Wray, No. 3811; King's Collector, No 7413.

3. *ILEX GRIFFITHII*, Hook. fil. Fl. Br. Ind. I, 601. A bush or small tree; young branches stout, pubescent or glabrescent. *Leaves* coriaceous, elliptic, rarely elliptic-rotund, acute, the edges serrulate, the base slightly narrowed; upper surface glabrous, except the depressed puberulous midrib; lower surface puberulous or glabrescent, the midrib prominent and pubescent; main nerves about 8 pairs, spreading, inter-arching far from the edge; length 1 to 2.5 in., breadth .5 to 1.3 in., petiole .15 to .25 in. *Flowers* 4-merous: the males fascicled, less than .2 in. in diam., on pedicels longer than themselves. *Female flowers* larger than the males, in smaller fascicles, and sometimes solitary. *Calyx* a shallow cup, with 4 broad shallow ciliolate lobes. *Petals* broadly oblong, obtuse, finally re-curved, connate near the base. *Ovary* globose; *stigma* sessile, 4-lobed. *Drupe* globose or ovoid-globose, glabrous or glabrescent, .15 in. in diam., the pulp scanty; *pyrenes* 4, coriaceous, rounded at the back; *pedicel* .35 to .6 in. long.

Malacca: Griffith, Maingay. Perak Wray, King's Collector.—
DISTRIB.: Sumatra, Java, Khasia Hills and Cachar, Assam.

4. *ILEX GLOMERATA*, King, n. sp. A glabrous shrub or small tree; young branches, slender, dark-coloured. *Leaves* thinly coriaceous, oblong or elliptic-oblong, acuminate, the edges entire slightly wavy and recurved when dry, the base cuneate; main nerves 6 or 7 pairs, curving, ascending, forking, obsolete on the upper, faint on the lower surface; length 3 to 4.5 in., breadth 1.3 to 1.75 in., petiole .3 to .4 in. *Male flowers* .2 in. in diam., in axillary fascicles of 6 to 12, their pedicels .15 in. long. *Calyx* minute, with 4 shallow rounded teeth. *Petals* 4, very much longer than the calyx, broadly ovate, membranous, slightly coherent by their bases, hypogynous. *Stamens* alternate with and longer than the petals, slightly adherent to them at the base; *filaments* subulate, much longer than the broad shortly ovoid sutured anthers; *E rudimentary ovary* ovoid, compressed, *stigma* sessile. *Female flowers* not known. *Drupe* globular, .3 or .35 in. in diam., the pulp copious; *pyrenes* 4, trigonous.

Perak: King's Collector, Curtis, No. 2091, Scortechini.

5. *ILEX MAINGAYI*, Hook. fil. Fl. Br. Ind. I, 605. A glabrous tree 20 to 30 feet high (60 to 80 *vide* Kunstler); young branches stout, lenticellate, dark-coloured. *Leaves* coriaceous, elliptic, narrowly elliptic-oblong or oblanceolate-oblong, sub-acuminate, the base narrowed; upper

surface shining, the lower dull and sub-glaucous; main nerves 10 or 12 pairs, sub-horizontal, faint on the lower, obsolete on the upper surface; length 4 to 5.5 in., breadth 1.35 to 2 in., petiole .4 to .65 in. *Male flowers* in pedicelled sub-umbellulate sub-racemose cymes about 1.25 in. long; the buds globular, less than .1 in. in diam. *Calyx lobes* 4 in the male, 6 in the female, rounded, not ciliate. *Petals in the male* 4, broadly oblong; *stamens* longer than the petals and attached to their bases. *Female flowers* in short racemes; *petals* and *stamens* 6, hypogynous. *Ripe drupes* ovoid or globular, .2 to .25 in. in diam., grooved when dry; *pedicels* stout, as long as the drupes, pulp scanty; *pyrenes* 4 to 6, trigonous, thickly coriaceous; *stigma* sessile, swollen.

Penang, Maingay; (Kew Distrib.), No. 1021; Curtis, No. 2152. Perak; Scortechini, King's Collector.

6. *ILEX MACROPHYLLA*, Wall. Cat. 4331. A tree 15 to 30 feet high; young branches stout, pale, sometimes lenticellate. *Leaves* coriaceous, elliptic to elliptic-oblong, obtuse or sub-acute, entire, the base slightly narrowed; upper surface shining with the midrib depressed and the nerves obsolete; the lower dull, the 12 pairs of spreading nerves slightly prominent and interarching freely at some distance from the edge; length 4 to 6 in., breadth 2 to 2.5 in., petiole about .5 in. *Cymes* dense, capituliform, often branching; their pedicels slender, axillary, longer than the petioles. *Flowers* .15 in. in diam., 4-6-merous. *Calyx* with broad deep teeth. *Petals* broadly oblong, obtuse in the male flowers, united at the base; in the females, free and sub-equal. *Stamens* longer than the corolla and inserted on it. *Drupes* sub-globular, .2 in. in diam., the *stigma* permanent and prominent; *pyrenes* about 8, trigonous.

Penang: Phillips, Wallich, Curtis, King's Collector. Malacca: Phillips, Maingay. Singapore: Ridley.

7. *ILEX CYMOsa*, Blume Bijdr. 1149. A glabrous tree 15 to 40 feet high; young branches slender, very pale. *Leaves* thinly coriaceous, elliptic-oblong to elliptic, the apex often shortly and bluntly acuminate, the base slightly narrowed or rounded, lower surface slightly glaucous; main nerves about 6 to 8 pairs, curved, ascending: length 2.5 to 4.5 in., breadth 1.35 to 2.5 in., petiole .25 to .35 in. *Cymes* solitary, pedunculate, branched and often paniculate, spreading, many-flowered, rather lax. *Flowers* .1 in. in diam.; their pedicels slender, .25 in. long. *Male flowers* 4-5-merous; the calyx lobes broad, rounded, ciliolate; *petals* broadly obtuse, about as long as the stamens. *Female flowers* with 5-6-merous calyx, and 6 to 8 short erect free concave slightly unequal petals; *ovary* globular-pyramidal; *style* short, thick; *stigma* large, hemispheric. *Drupes* globular, ovoid, crowned by the persistent style and stigma,